Fuel System (D4EA)

GENERAL

BASIC TROUBLESHOOTING

DIESEL CONTROL SYSTEM

FL

DTC TROUBLESHOOTING PROCEDURES

FUEL DELIVERY SYSTEM

GENERAL

SPECIFICATION E988BD7A

Items		Specification		
Fuel Tank		Capacity	58ℓ	
Fuel Pump	Low Pressure Pump	Type	Electrical, in-tank type	
		Driven by	Electrical motor	
	High Pressure Pump	Type	Mechanical	
		Dirven by	Mechanical gear	
Fuel filter		Type	High pressure type	
Fuel Pressure (at high pressure side)		Maximum Pressure	1,350 bar (135 MPa, 19,580 psi)	
Sensors	Mass Air Flow Sensor (MAFS)	Type	HFM5 (Hot film sensor)	
		Specification	8 kg/h	1.20 V
			10 kg/h	1.26 V
			15 kg/h	1.41 V
			30 Kg/h	1.77 V
			60 Kg/h	2.24 V
			120 Kg/h	2.82 V
			250 Kg/h	3.55 V
			370 Kg/h	3.97 V
			480 Kg/h	4.28 V
	Intake Air Temperature Sensor (IATS)	Type	Thermister type	
		Specification	-40°C(-40°F)	35.14 ~ 43.76 kΩ
			-20°C(-4°F)	35.14 ~ 43.76 kΩ
			0°C(32°F)	35.14 ~ 43.76 kΩ
			20°C(68°F)	35.14 ~ 43.76 kΩ
			40°C(104°F)	35.14 ~ 43.76 kΩ
			60°C(140°F)	35.14 ~ 43.76 kΩ
			80°C(176°F)	35.14 ~ 43.76 kΩ
	Accelerator Position Sensor (APS)	Output Voltage (Sensor 1)	C.T	0.7 ~ 0.8 V
			W.O.T	3.8 ~ 4.4 V
		Output Voltage (Sensor 2)	C.T	0.275 ~ 0.475 V
			W.O.T	1.75 ~ 2.35 V
	Camshaft Position Sensor (CMPS)	Type	Hall IC type	
	Crankshaft Position Sensor (CKPS)	Type	Magnetic sensor type	

Items		Specification		
Sensors	Rail Pressure Sensor (RPS)	Type	Piezo electrictiy type	
		Output Voltage	0 MPa	0.5V
			20 MPa	1.03V
			40 MPa	1.57V
			60 MPa	2.10V
			100 MPa	3.17V
			130 MPa	3.97V
			135 MPa	4.10V
			150 MPa	4.50V
	Fuel Temperature Sensor (FTS)	Type	Thermister type	
		Specification	-20°C	13.2 ~ 18.1 kΩ
			0°C	5.2 ~ 6.6 kΩ
			20°C	2.27 ~ 2.73 kΩ
			40°C	1.06 ~ 1.28 kΩ
			60°C	0.54 ~ 0.65 kΩ
			80°C	0.32 ~ 0.39 kΩ
	Engine Coolant Temperature Sensor (ECTS)	Type	Thermister type	
		Specification	-40°C(-40°F)	48.14 kΩ
			-20°C(-4°F)	14.13 ~ 16.83 kΩ
			0°C(32°F)	5.79 kΩ
			20°C(68°F)	2.31 ~ 2.59 kΩ
			40°C(104°F)	1.15 kΩ
			60°C(140°F)	0.59 kΩ
			80°C(176°F)	0.32 kΩ
	Vehicle Speed Sensor (VSS)	Type	Hall IC type	
Actuators	Injector	Type	Electromagnetic type	
		Coil resistance	0.33 Ω at 20°C	
	EGR Solenoid Valve	Coil resistance	14.7 ~ 16.1 Ω at 20°C	
	Throttle Plate Vacuum Modulator	Coil resistance	14.7 ~ 16.1 Ω at 20°C	
	Fuel Pressure Regulator Valve	Coil resistance	2.07 ~ 2.53 Ω at 20°	

SEALANT

Engine Coolant Temperature Sensor	THREE BOND TB 2403

SERVICE STANDARD

Curb Idle Speed (rpm)	N-Range	A/CON OFF	720 ± 40 rpm
		A/CON ON	720 ± 40 rpm

TIGHTENING TORQUES

Item		N·m	lb·ft
Engine Control System	Camshaft Position Sensor (CMPS) installation bolt	4 ~ 6	2.95 ~ 4.43
	Crankshaft Position Sensor (CKPS) installation bolt	4 ~ 6	2.95 ~ 4.43
	Engine Coolant Temperature Sensor (ECTS) installation bolt	20 ~ 40	14.75 ~ 29.50
	Rail Pressure Sensor (RPS) installation	33 ~ 37	24.34 ~ 27.29
	EGR solenoid valve and Throttle Plate Vacuum Modulator bracket installation bolt	7 ~ 11	5.16 ~ 8.11
	EGR Valve installation nut	25 ~ 30	18.44 ~ 22.13
	Glow Plug installation nut	10 ~ 14	7.38 ~ 10.33
	Glow Plug nut-washer installation	0.8 ~ 1.5	0.59 ~ 1.11
	Oil Pressure Switch installation	15 ~ 22	11.06 ~ 16.23
	ECM bracket installation bolt/nut	4 ~ 6	2.95 ~ 4.43
	Fuel Pressure Regulator Valve installation bolt	4 ~ 6	2.95 ~ 4.43
	Accelerator Pedal Module installation bolt	8 ~ 12	5.90 ~ 8.85
Fuel Delivery System	High Pressure Pipe (Rail ↔ Injector)	25 ~ 29	18.44 ~ 21.39
	High Pressure Pipe (Rail ↔ High Pressure Pump	25 ~ 29	18.44 ~ 21.39
	High Pressure Pump installation bolt	13 ~ 18	9.59 ~ 13.28
	Common Rail installation bolt	8 ~ 10	5.90 ~ 7.38
	Injector Clamp installation bolt	25 ~ 29	18.44 ~ 21.39
	Fuel Filter mounting bolt	9 ~ 14	6.64 ~ 10.33
	Fuel Tank Band installation nut	39 ~ 54	28.8 ~ 40

BASIC TROUBLESHOOTING E4F9FBE4

BASIC TROUBLESHOOTING GUIDE

1	Bring Vehicle to Workshop

2	Analyze Customer's Problem

- Ask the customer about the conditions and environment relative to the issue (Use CUSTOMER PROBLEM ANALYSIS SHEET).

3	Verify Symptom, and then Check DTC and Freeze Frame Data

- Connect Hi-Scan (Pro) to Diagnostic Link Connector (DLC).
- Record the DTC and freeze frame data.

To erase DTC and freeze frame data, refer to Step 5.

4	Confirm the Inspection Procedure for the System or Part

- Using the SYMPTOM TROUBLESHOOTING GUIDE CHART, choose the correct inspection procedure for the system or part to be checked.

5	Erase the DTC and Freeze Frame Data

(WARNING)
NEVER erase DTC and freeze frame data before completing Step 2 MIL/DTC in "CUSTOMER PROBLEM ANALYSIS SHEET".

6	Inspect Vehicle Visually

- Go to Step 11, if you recognize the problem.

7	Recreate (Simulate) Symptoms the DTC

- Try to recreate or simulate the symptoms and conditions of the malfunction as described by customer.
- If DTC(s) is/are displayed, simulate the condition according to troubleshooting procedure for the DTC.

8	Confirm Symptoms of Problem

- If DTC(s) is/are not displayed, go to Step 9.
- If DTC(s) is/are displayed, go to Step 11.

9	Recreate (Simulate) Symptom

- Try to recreate or simulate the condition of the malfunction as described by the customer.

10	Check the DTC

- If DTC(s) does(do) not occur, refer to BASIC INSPECTION in INTERMITTENT PROBLEM PROCEDURE.
- If DTC(s) occur(s), go to Step 11.

11	Perform troubleshooting procedure for DTC

12	Adjust or repair the vehicle

13	Confirmation test

14	END

CUSTOMER PROBLEM ANALYSIS SHEET

1. VEHICLE INFORMATION

(I) VIN:
(II) Production Date:
(III) Odometer Reading: (km)

2. SYMPTOMS

□ Unable to start	□ Engine does not turn over □ Incomplete combustion □ Initial combustion does not occur
□ Difficult to start	□ Engine turns over slowly □ Other________________
□ Poor idling	□ Rough idling □ Incorrect idling □ Unstable idling (High: ______ rpm, Low: ______rpm) □ Other ________________________________
□ Engine stall	□ Soon after starting □ After accelerator pedal depressed □ After accelerator pedal released □ During A/C ON □ Shifting from N to D-range □ Other ____
□ Others	□ Poor driving (Surge) □ Knocking □ Poor fuel economy □ Back fire □ After fire □ Other __________________________

3. ENVIRONMENT

Problem frequency	□ Constant □ Sometimes (________________) □ Once only □ Other ____
Weather	□ Fine □ Cloudy □ Rainy □ Snowy □ Other ________________
Outdoor temperature	Approx. _____ °C/°F
Place	□ Highway □ Suburbs □ Inner City □ Uphill □ Downhill □ Rough road □ Other _________________________________
Engine temperature	□ Cold □ Warming up □ After warming up □ Any temperature
Engine operation	□ Starting □ Just after starting (____ min) □ Idling □ Racing □ Driving □ Constant speed □ Acceleration □ Deceleration □ A/C switch ON/OFF □ Other ___________________________

4. MIL/DTC

MIL (Malfunction Indicator Lamp)	□ Remains ON □ Sometimes lights up □ Does not light
DTC	□ Normal □ DTC (________________________________) □ Freeze Frame Data

BASIC INSPECTION PROCEDURE

MEASURING CONDITION OF ELECTRONIC PARTS' RESISTANCE

The measured resistance at high temperature after vehicle running may be high or low. So all resistance must be measured at ambient temperature (20℃, 68°F), unless there is any notice.

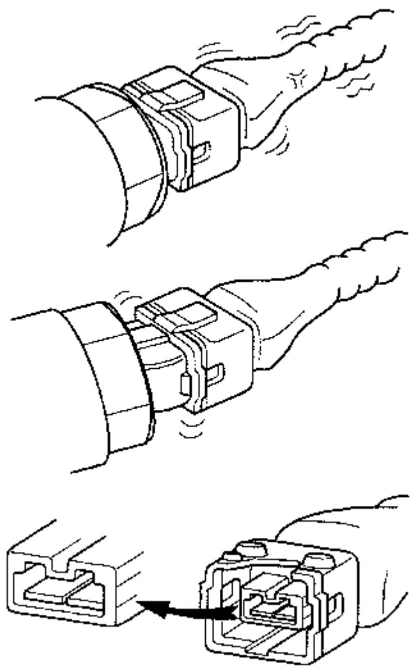
NOTE

The measured resistance in except for ambient temperature (20 ℃, 68 °F) is reference value.

INTERMITTENT PROBLEM INSPECTION PROCEDURE

Sometimes the most difficult case in troubleshooting is when a problem symptom occurs but does not occur again during testing. An example would be if a problem appears only when the vehicle is cold but has not appeared when warm. In this case, technician should thoroughly make out a "CUSTOMER PROBLEM ANALYSIS SHEET" and recreate (simulate) the environment and condition which occurred when the vehicle was having the issue.

1. Clear Diagnostic Trouble Code (DTC).
2. Inspect connector connection, and check terminal for poor connections, loose wires, bent, broken or corroded pins, and then verify that the connectors are always securely fastened.



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3. Slightly shake the connector and wiring harness vertically and horizontally.
4. Repair or replace the component that has a problem-.
5. Verify that the problem has disappeared with the road test.

- SIMULATING VIBRATION

a. Sensors and Actuators

: Slightly vibrate sensors, actuators or relays with finger.

WARNING

Strong vibration may break sensors, actuators or relays

b. Connectors and Harness

: Lightly shake the connector and wiring harness vertically and then horizontally.

- SIMULATING HEAT

a. Heat components suspected of causing the malfunction with a hair dryer or other heat sourre.

WARNING

- DO NOT heat components to the point where they may be damaged.
- DO NOT heat the ECM directly.

- SIMULATING WATER SPRINKLING

a. Sprinkle water onto vehicle to simulate a rainy day or a high humidity condition.

WARNING

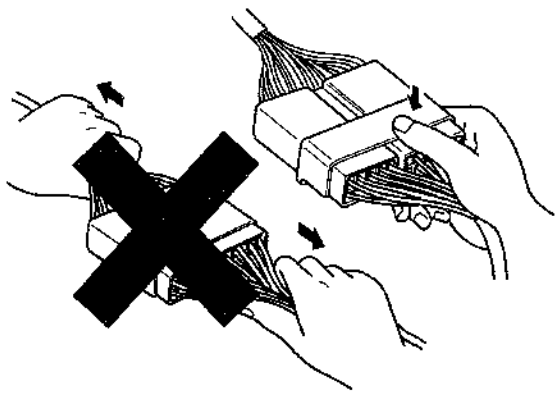
DO NOT sprinkle water directly into the engine compartment or electronic components.

- SIMULATING ELECTRICAL LOAD

a. Turn on all electrical systems to simulate excessive electrical loads (Radios, fans, lights, etc.).

CONNECTOR INSPECTION PROCEDURE

1. Handling of Connector
   a. Never pull on the wiring harness when disconnecting connectors.



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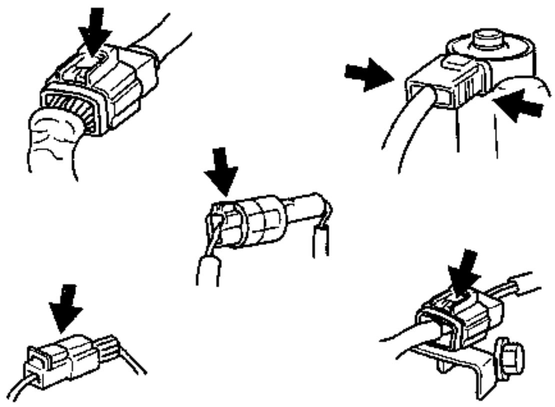
   b. When removing the connector with a lock, press or pull locking lever.



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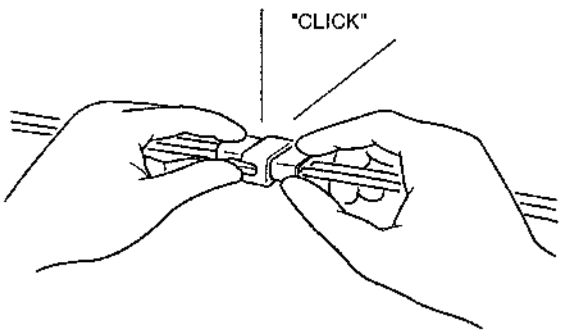
   c. Listen for a click when locking connectors. This sound indicates that they are securely locked.



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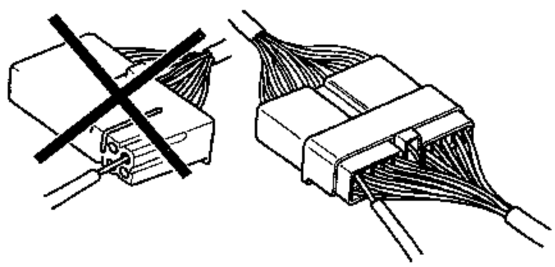
   d. When a tester is used to check for continuity, or to measure voltage, always insert tester probe from wire harness side.



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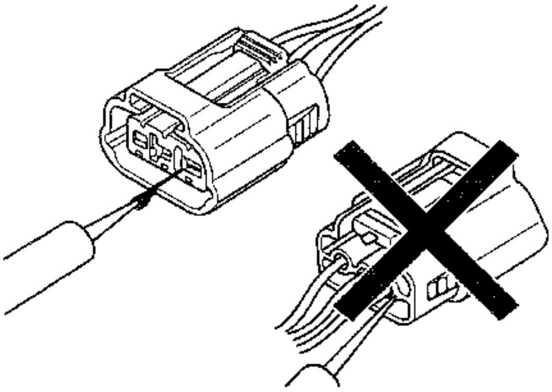
e. Check waterproof connector terminals from the connector side. Waterproof connectors cannot be accessed from harness side.



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NOTE

- Use a fine wire to prevent damage to the terminal.
- Do not damage the terminal when inserting the tester lead.

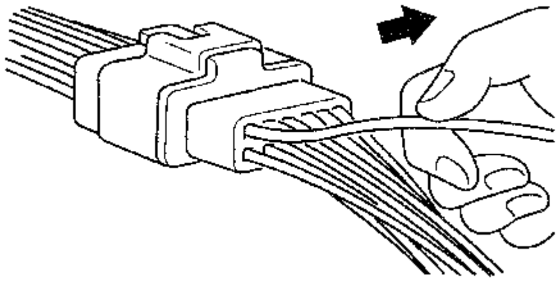
2. Checking Point for Connector
   a. While the connector is connected:

      Hold the connector, check connecting condition and locking efficiency.
   b. When the connector is disconnected:

      Check missed terminal, crimped terminal or broken core wire by slightly pulling the wire harness.

      Visually check for rust, contamination, deformation and bend.
   c. Check terminal tightening condition:

      Insert a spare male terminal into a female terminal, and then check terminal tightening conditions.
   d. Pull lightly on individual wires to ensure that each wire is secured in the terminal.



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3. Repair Method of Connector Terminal
   a. Clean the contact points using air gun and/or shop rag.

      NOTE

      Never use sand paper when polishing the contact points, otherwise the contact point may be damaged.
   b. In case of abnormal contact pressure, replace the female terminal.

WIRE HARNESS INSPECTION PROCEDURE

1. Before removing the wire harness, check the wire harness position and crimping in order to restore it correctly.
2. Check whether the wire harness is twisted, pulled or loosened.
3. Check whether the temperature of the wire harness is abnormally high.
4. Check whether the wire harness is rotating, moving or vibrating against the sharp edge of a part.
5. Check the connection between the wire harness and any installed part.
6. If the covering of wire harness is damaged; secure, repair or replace the harness.

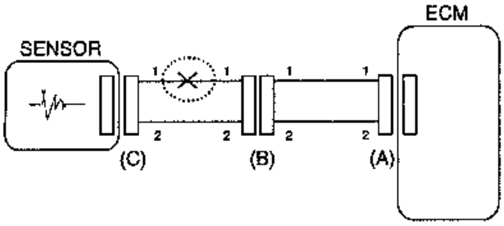
ELECTRICAL CIRCUIT INSPECTION PROCEDURE

- CHECK OPEN CIRCUIT

1. Procedures for Open Circuit
   - Continuity Check
   - Voltage Check

   If an open circuit occurs (as seen in [FIG. 1]), it can be found by performing Step 2 (Continuity Check Method) or Step 3 (Voltage Check Method) as shown below.

FIG. 1



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2. Continuity Check Method

   NOTE

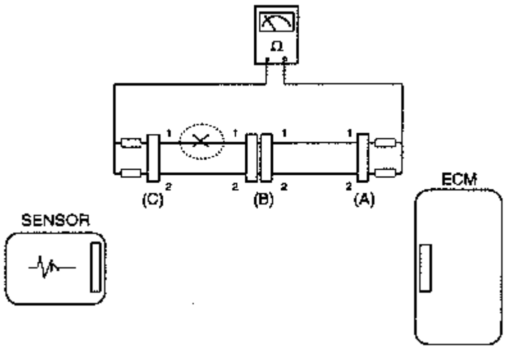
   When measuring for resistance, lightly shake the wire harness above and below or from side to side.

Specification (Resistance)
1Ω or less → Normal Circuit
1MΩ or Higher → Open Circuit

   a. Disconnect connectors (A), (C) and measure resistance between connector (A) and (C) as shown in [FIG. 2].

   In [FIG.2.] the measured resistance of line 1 and 2 is higher than 1MΩ and below 1 Ω respectively. Specifically the open circuit is line 1 (Line 2 is normal). To find exact break point, check sub line of line 1 as described in next step.

FIG. 2



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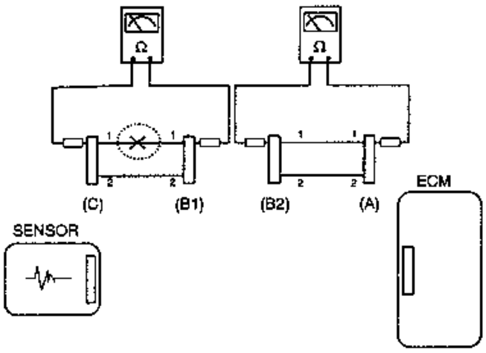
   b. Disconnect connector (B), and measure for resistance between connector (C) and (B1) and between (B2) and (A) as shown in [FIG. 3].

   In this case the measured resistance between connector (C) and (B1) is higher than 1MΩ and the open circuit is between terminal 1 of connector (C) and terminal 1 of connector (B1).

FIG. 3



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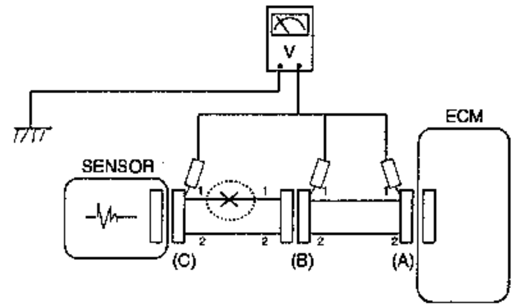
3. Voltage Check Method
   a. With each connector still connected, measure the voltage between the chassis ground and terminal 1 of each connectors (A), (B) and (C) as shown in [FIG. 4].

      The measured voltage of each connector is 5V, 5V and 0V respectively. So the open circuit is between connector (C) and (B).

FIG. 4



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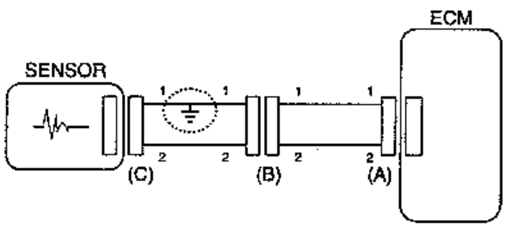
• CHECK SHORT CIRCUIT

1. Test Method for Short to Ground Circuit

- Continuity Check with Chassis Ground

If short to ground circuit occurs as shown in [FIG. 5], the broken point can be found by performing below Step 2 (Continuity Check Method with Chassis Ground) as shown below.

FIG. 5



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2. Continuity Check Method (with Chassis Ground)

   NOTE

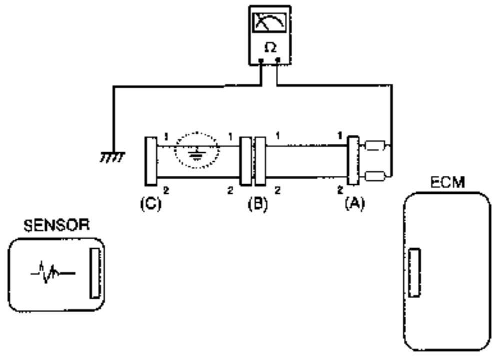
   Lightly shake the wire harness above and below, or from side to side when measuring the resistance.

Specification (Resistance)
1Ω or less → Short to Ground Circuit
1MΩ or Higher → Normal Circuit

a. Disconnect connectors (A), (C) and measure for resistance between connector (A) and Chassis Ground as shown in [FIG. 6].

   The measured resistance of line 1 and 2 in this example is below 1Ω and higher than 1MΩ respectively. Specifically the short to ground circuit is line 1 (Line 2 is normal). To find exact broken point, check the sub line of line 1 as described in the following step.

FIG. 6



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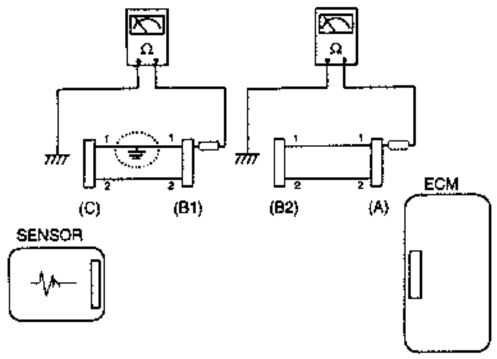
b. Disconnect connector (B), and measure the resistance between connector (A) and chassis ground, and between (B1) and chassis ground as shown in [FIG. 7]-.

The measured resistance between connector (B1) and chassis ground is 1Ω or less. The short to ground circuit is between terminal 1 of connector (C) and terminal 1 of connector (B1).

FIG. 7



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ECM PROBLEM INSPECTION PROCEDURE

1. TEST ECM GROUND CIRCUIT: Measure resistance between terminals 1, 2 ECM C230-1 connector and chassis ground using the backside of ECM harness connector as ECM side check point. If the problem is found, repair it.

Specification (Resistance)

Between terminal 1 of C230-1 connector and chassis ground : 1Ω or less

Between terminal 2 of C230-1 connector and chassis ground : 1Ω or less

Between terminal 3 of C230-1 connector and chassis ground : 1Ω or less

2. TEST ECM CONNECTOR: Disconnect the ECM connector and visually check the ground terminals on ECM side and harness side for bent pins or poor contact contact pressure. If the problem is found, repair it.

3. If problem is not found in Step 1 and 2, the ECM could be faulty. If so, replace the ECM with a new one, and then check the vehicle again. If the vehicle operates normally then the problem was likely with the ECM.

4. RE-TEST THE ORIGINAL ECM : Install the original ECM (may be broken) into a known-good vehicle and check the vehicle. If the problem occurs again, replace the original ECM with a new one. If problem does not occur, this is intermittent problem (Refer to INTERMITTENT PROBLEM PROCEDURE in BASIC INSPECTION PROCEDURE).

INSPECTION CHART FOR DIAGNOSTIC TROUBLE CODES

DTC	DESCRIPTION	MIL
P0100	Air Flow Sensor Circuit - Malfunction	●
P0101	Air Flow Sensor Circuit - Range/Performance Problem	●
P0102	Air Flow Sensor Circuit - Low Input	●
P0103	Air Flow Sensor Circuit - High Input	●
P0112	Intake Air Temperature Circuit - Low Input	▲
P0113	Intake Air Temperature Circuit - High Input	▲
P0116	Engine Coolant Temperature Circuit - Range/Performance Problem	▲
P0117	Engine Coolant Temperature Circuit - Low Input	▲
P0118	Engine Coolant Temperature Circuit - High Input	▲
P0120	Throttle/Pddal Postion Sensor 1 - General Error	●
P0123	Throttle/Pddal Postion Sensor 1 - High Input	●
P0182	Fuel Temperature Sensor - Low Input	▲
P0183	Fuel Temperature Sensor - High Input	▲
P0190	Fuel Rail Pressure Sensor - General Error	●
P0192	Fuel Rail Pressure Sensor - Low Input	●
P0193	Fuel Rail Pressure Sensor - High Input	●
P0220	Throttle/Pddal Postion Sensor 2 - General Error	●
P0223	Throttle/Pddal Postion Sensor 2 - High Input	●
P0231	Electric Fuel Pump Relay - Open or Short Circuit	▲
P0232	Electric Fuel Pump Relay - Short Circuit	▲
P0261	Cylinder 1 - Injector Circuit Low (Over Current Low Side)	●
P0262	Cylinder 1 - Injector Circuit High (Over Current High Side)	●
P0263	Cylinder 1 - Injector Circuit Balance (Load Drop is Detected)	●
P0264	Cylinder 2 - Injector Circuit Low (Over Current Low Side)	●
P0265	Cylinder 2 - Injector Circuit High (Over Current High Side)	●
P0266	Cylinder 2 - Injector Circuit Balance (Load Drop is Detected)	●
P0267	Cylinder 3 - Injector Circuit Low (Over Current Low Side)	●
P0268	Cylinder 3 - Injector Circuit High (Over Current High Side)	●
P0269	Cylinder 3 - Injector Circuit Balance (Load Drop is Detected)	●
P0270	Cylinder 4 - Injector Circuit Low (Over Current Low Side)	●
P0271	Cylinder 4 - Injector Circuit High (Over Current High Side)	●
P0272	Cylinder 3 - Injector Circuit Balance (Load Drop is Detected)	●
P0336	Crankshaft Position Sensor Circuit Range/Performance Problem	▲
P0341	Camsshaft Position Sensor Circuit Range/Performance (Single Sensor)	▲
P0343	Camsshaft Position Sensor Circuit High Input	▲
P0401	Exhaust Gas Recirculation Flow Insufficent Detected	●
P0402	Exhaust Gas Recirculation Flow Excessive Detected	●
P0405	EGR Actuator Circuit - Open or Short Circuit	●

DTC	DESCRIPTION	MIL
P0406	EGR Actuator Circuit - Short Circuit	•
P0501	Vehicle Speed Sensor - Range/Performance Problem	▲
P0503	Vehicle Speed Sensor - Intermittent/High	▲
P0504	Stop Lamp (Brake) Switch - Malfunction	▲
P0562	System Voltage - Low Input	▲
P0563	System Voltage - High Input	▲
P0600	CAN Communication Line - Malfunction	▲
P0601	EEPROM - Check Sum Error	•
P0602	EEPROM Programming Error	•
P0603	EEPROM and Configuration - Data Set Error	•
P0650	Malfunction Indicator Lamp - Malfunction	▲
P0704	Clutch Switch - Malfunction	▲
P1182	Fuel Pressure Regulator - Short Circuit	•
P1183	Fuel Pressure Regulator - Open or Short Circuit	•
P1184	Fuel Pressure Regulator - General Error	•
P1185	Fuel Pressure Monitoring - Maximum Pressure Exceeded	•
P1186	Fuel Pressure Monitoring - Maximum Pressure at Engine Speed Too Low	•
P1187	Fuel Pressure Monitoring - Regulator Valve Stick	•
P1188	Fuel Pressure Monitoring - Leakage	•
P1189	Fuel Pressure Monitoring - Governor Deviation at Engine Speed Too High	•
P1190	Intake Throttle Actuator - Malfunction	▲
P1300	Injector Specific Data Fault	▲
P1321	Glow Indicator Lamp - Short Circuit	▲
P1322	Glow Indicator Lamp - Open Circuit	▲
P1326	Glow Relay - Short Circuit	▲
P1327	Glow Relay - Open Circuit	▲
P1522	Sensor Supply Voltage 1 - Low Input	▲
P1523	Sensor Supply Voltage 1 - High Input	▲
P1524	Sensor Supply Voltage 2 - Low Input	▲
P1525	Sensor Supply Voltage 2 - High Input	▲
P1529	TCM Engine Check Lamp Request	•
P1545	1st Gear Recognition Switch - Short Circuit	▲
P1546	1st Gear Recognition Switch - Open or Short Circuit	▲
P1616	Main Relay - Malfunction	•
P1634	Water Heater Relay - Malfunction	▲
P1636	Voltage Regulator for Injector	▲
P1638	ECM Error	▲
P1639	ECM Error (A/D converter)	▲
P1646	Capacitor1 Voltage - High Input	▲
P1647	Capacitor1 Voltage - Low Input	▲

DTC	DESCRIPTION	MIL
P1652	Ignition Switch - Malfunction	▲
P1653	Error Check after IG OFF - Malfunction	▲
P1690	Immobilizer Malfunction - SMARTRA/Antena Error	▲
P1692	Immobilizer Indicator Lamp Error	▲
P1693	Immobilizer Malfunction - Transponder Error	▲
P1695	Immobilizer Malfunction - EEPROM Error	▲
P1696	Immobilizer Malfunction - Authentication not successful	▲
P1697	Immobilizer Malfunction - Invalid tester request	▲
P1698	Immobilizer Malfunction - Key IDE not valid	▲
P1765	Immobilizer Reduction Signal - Malfunction	▲
P2135	Accelerator Postion Sensor Switch 1/2 Voltage Correction	●
P2228	Atmospheric Pressure Sensor - Low Input	▲
P2229	Atmospheric Pressure Sensor - High Input	▲

NOTE

○ : MIL ON & Fault code memory

△ : MIL OFF & Fault code memory

Refer to the Group "BE" for the troubleshooting procedures of the DTC P1690, P1692, P1693, P1695, P1696, P1697 and P1698.

SYMPTOM TROUBLESHOOTING GUIDE CHART (I)

Problem	Possible cause
Engine does not start	Run out of petrol
	Starter out of order
	Pump hose supply cut
	High pressure leakage
	Fuse out of order
	The compensation of individual injector not adapted
	Drift of the water temperature sensor not detected
	Drift of the rail pressure sensor not detected
	Cam and Crank signals missing simultaneously
	Battery voltage too low
	Faulty antitheft
	EGR valve blocked open (engine doesn't start)
	Fuel pressure regulator valve contaminated, stuck, jammed
	Fuel quality / presence of water
	Inversion of low pressure fuel connections
	Fuel filter not adapted
	Low pressure fuel circuit sealed
	Sealed fuel filter
	Intermittent fault connection
	Air ingress in the low pressure fuel circuit
	Fuel return circuit of the pump sealed
	Air heaters out of order
	Engine compression too low
	Leakage at eh injector valve
	Low pressure fuel pump out of order
	High pressure pump out of order
	Injector jammed open
	Bug software of hardware fault not detected

Problem	Possible cause
Engine starts with difficulty or starts and stall	Run out of fuel
	Fuel return hose of nozzle holder cut
	High pressure leakage
	Fuse out of order
	Air filter sealed
	Alternator or voltage regulator out of order
	The compensation of individual injector not adapted
	Drift of the water temperature sensor not detected
	Drift of the rail pressure sensor not detected
	Battery voltage too low
	EGR valve blocked open (engine doesn't start)
	Fuel pressure regulator valve contaminated, stuck, jammed
	Fuel quality / presence of water
	Inversion of low pressure fuel connections
	Fuel filter not adapted
	Low pressure fuel circuit sealed
	Sealed fuel filter
	Oil level too high / too low
	Catalytic converter sealed or damaged
	Intermittent fault connection
	Air ingress in the llw pressure fuel circuit
	Fuel return circuit of the pump sealed
	Air heaters out of order
	Engine compression too low
	Fuel return hose of nozzle holder sealed
	Carbon deposit on the injector (sealed holes)
	Needle stuck (injection possible over a certain pressure)
	Petrol in fuel
	Bug software or hardware fault not detected

Problem	Possible cause
Poor starting when hot	The compensation of individual injector not adapted
	Drift of the rail pressure sensor not detected
	Drift of the water temperature sensor not detected
	EGR valve blocked open (engine doesn't start)
	Fuel pressure regulator valve contaminated, stuck, jammed
	Air filter sealed
	Fuel filter not adapted
	Air ingress in the low pressure fuel circuit
	Fuel quality / presence of water
	Fuel return circuit of the pump sealed
	Sealed fuel filter
	Engine compression too low
	Intermittent fault connection
	Carbon deposit on the injector (sealed holes)
	Needle stuck (injection possible over a certain pressure)
	Petrol in fuel
	Bug software or hardware fault not detected
Unstable idling	Fuel return hose of nozzle holder cut
	The compensation of individual injector not adapted
	Drift of the rail pressure sensor not detected
	Drift of the sensors used to evaluate& the air flow not detected
	Harness resistance increased
	Fuel filter not adapted
	Air ingress in the low pressure fuel circuit
	Fuel quality / presence of water
	Sealed fuel filter
	Air filter sealed
	Fuel return hose of nozzle holder sealed
	High pressure leakage
	Air heaters out of order
	Engine compression too low
	Bad flanging of the injector
	High pressure pump out of order
	Injector not adapted
	Carbon deposit on the injector (sealed holes)
	Needle stuck (injection possible over a certain pressure)
	Injector jammed open

Problem	Possible cause
Idle speed too high / too low	Drift of the engine coolant temperature sensor not detected
	Incorrect state of the electrical pack devices
	Alternator or voltage regulator out of order
	Clutch not well set
	Bug software or hardware fault not detected
Blue, white, black smokes	The compensation of individual injector not adapted
	Drift of the sensors used to evaluate& the air flow not detected
	Drift of the engine coolant temperature sensor not detected
	Drift of the rail pressure sensor not detected
	EGR valve blocked open (engine doesn't start)
	Fuel pressure regulator valve contaminated, stuck, jammed
	Oil level too high / too low
	Fuel quality / presence of water
	Catalytic converter sealed or damaged
	Air filter sealed
	Oil suction (engine racing)
	Air heaters out of order
	Engine compression too low
	Bad flanging of the injector
	Injector washer not adapted, forgotten, doubled
	Injector not adapted
	Carbon deposit on the injector (sealed holes)
	Injector jammed open
	Petrol in fuel
Engine rattling, noisy engine	The compensation of individual injector not adapted
	EGR valve blocked closed (noisy engine)
	EGR valve blocked open (engine doesn't start)
	Drift of the engine coolant temperature sensor not detected
	Drift of the sensors used to evaluate& the air flow not detected
	Air heaters out of order
	Engine compression too low
	Fuel return hose of nozzle holder sealed
	Drift of the rail pressure sensor not detected
	Injector washer not adapted, forgotten, doubled
	Injector not adapted
	Carbon deposit on the injector (sealed holes)
	Needle stuck (injection possible over a certain pressure)
	Injector jammed open

Problem	Possible cause
Burst noise	The compensation of individual injector not adapted
	Intermittent fault connection
	Drift of the rail pressure sensor not detected
	Fuel pressure regulator valve contaminated, stuck, jammed
	Bug software or hardware fault not detected
Untimely acceleration/deceleration and engine racing	Accelerator position sensor blocked (cable jammed)
	EGR valve blocked open (engine doesn't start)
	Intermittent fault connection
	Oil suction (engine racing)
	Drift of the rail pressure sensor not detected
	Bug software or hardware fault not detected
Gap when accelerating and at re-coupling (response time)	Air inlet circuit open
	Incorrect state of the electrical pack devices
	Accelerator position sensor blocked (cable jammed)
	EGR valve blocked open (engine doesn't start)
	Turbo charger damaged
	Fuel filter not adapted
	Sealed fuel filter
	Engine compression too low
	High pressure leakage
	Fuel pressure regulator valve contaminated, stuck, jammed
	Needle stuck (injection possible over a certain pressure)
	Bug software or hardware fault not detected

Problem	Possible cause
Engine stop/stalling	Run out of fuel
	Pump hose supply cut
	High pressure leakage
	Fuse out of order
	Fuel quality / presence of water
	Low pressure fuel circuit sealed
	Sealed fuel filter
	Cam and Crank signals missing simultaneously
	EGR valve blocked open (engine doesn't start)
	Fuel pressure regulator valve contaminated, stuck, jammed
	Alternator or voltage regulator out of order
	Intermittent fault connection
	Catalytic converter sealed or damaged
	Oil suction (engine racing)
	Low pressure fuel pump out of order
	High pressure pump out of order
	Faulty ignition key
	Petrol in fuel
	Bug software or hardware fault not detected

Problem	Possible cause
Engine judder	Run out of fuel
	Fuel return hose of nozzle holder cut
	Incorrect state of the electrical pack devices
	The compensation of individual injector not adapted
	Drift of the sensors used to evaluate& the air flow not detected
	EGR valve blocked open (engine doesn't start)
	Fuel filter not adapted
	Air ingress in the low pressure fuel circuit
	Fuel quality / presence of water
	Sealed fuel filter
	Intermittent fault connection
	Harness resistance increased
	Air heaters out of order
	Engine compression too low
	Fuel return hose of nozzle holder sealed
	Valve clearance
	Low pressure fuel pump out of order
	Injector washer not adapted, forgotten, doubled
	Carbon deposit on the injector (sealed holes)
	Needle stuck (injection possible over a certain pressure)
	Injector jammed open
	Petrol in fuel
	Bug software of hardware fault not detected

Problem	Possible cause
Lack of power	The compensation of individual injector not adapted
	Accelerator position sensor blocked (cable jammed)
	Incorrect state of the electrical pack devices
	Drift of the sensors used to evaluate& the air flow not detected
	EGR valve blocked open (engine doesn't start)
	Air inlet circuit open
	Air filter sealed
	Oil level too high / too low
	Catalytic converter sealed or damaged
	Turbo charger damaged
	Fuel filter not adapted
	Sealed fuel filter
	Leakage at the injector valve
	Fuel return circuit of the pump sealed
	Fuel return hose of nozzle holder sealed
	Engine compression too low
	Injector not adapted
	Carbon deposit on the injector (sealed holes)
	Valve clearance
Too much power	EGR valve blocked closed (noisy engine)
	The compensation of individual injector not adapted
	Oil suction (engine recing)
	Injector not adapted
	Bug software of hardware fault not detected

Problem	Possible cause
Excessive fuel consumption	Fuel return hose of nozzle holder cut
	Leakage at the Fuel pressure regulator valve
	Leakage at fuel temperature sensor
	Leakage at the spacers
	High pressure leakage
	Air inlet circuit open
	Air filter sealed
	The compensation of individual injector not adapted
	EGR valve blocked open (engine doesn't start)
	Incorrect state of the electrical pack devices
	Oil level too high / too low
	Fuel quality / presence of water
	Catalytic converter sealed or damaged
	Turbo charger damaged
	Engine compression too low
	Injector not adapted
	Bug software or hardware fault not detected
Over speed engine when changing the gear box ratio	Accelerator position sensor blocked (cable jammed)
	The compensation of individual injector not adapted
	Intermittent fault connection
	Clutch not well set
	Oil suction (engine racing)
	Turbo charger damaged
	Injector not adapted
	Bug software or hardware fault not detected
Exhaust smells	EGR valve blocked open (engine doesn't start)
	Oil suction (engine racing)
	Turbo charger damaged
	Oil level too high / too low
	The compensation of individual injector not adapted
	Catalytic converter sealed or damaged
	Bad flanging of the injector
	Injector washer not adapted, forgotten, doubled
	Injector not adapted
	Carbon deposit on the injector (sealed holes)
	Needle stuck (injection possible over a certain pressure)
	Injector jammed open
	Bug software or hardware fault not detected

Problem	Possible cause
Smokes (black, white, blue) when accelerating	The compensation of individual injector not adapted
	EGR valve blocked open (engine doesn't start)
	Drift of the sensors used to evaluate& the air flow not detected
	Air filter sealed
	Fuel quality / presence of water
	Oil level too high / too low
	Turbo charger damaged
	Catalytic converter sealed or damaged
	Oil suction (engine racing)
	Air heaters out of order
	Engine compression too low
	High pressure leakage
	Intermittent fault connection
	Bad flanging of the injector
	Injector washer not adapted, forgotten, doubled
	Injector not adapted
	Carbon deposit on the injector (sealed holes)
	Needle stuck (injection possible over a certain pressure)
	Injector jammed open
	Petrol in fuel
	Bug software or hardware fault not detected
Fuel smells	Pump hose supply cut
	Fuel return hose of nozzle holder cut
	Leakage at the fuel pressure regulator valve
	Leakage at fuel temperature sensor
	Leakage at the spacers
	High pressure leakage

Problem	Possible cause
The engine collapses at take off	Accelerator position sensor blocked (cable jammed)
	Incorrect state of the electrical pack devices
	Air filter sealed
	Inversion of low pressure fuel connections
	Fuel filter not adapted
	Fuel quality / presence of water
	Air ingress in the low pressure fuel circuit
	Sealed fuel filter
	Catalytic converter sealed or damaged
	Clutch not well set
	Intermittent fault connection
	Drift of teh rail pressure sensor not detected
	Fuel pressure regulator valve contaminated, stuck, jammed
	Petrol in fuel
	Bug software or hardware fault not detected
The engine does not stop	Faulty ignition key
	Oil suction (engine racing)
	Bug software or hardware fault not detected
Different mechanical noises	Buzzer noise (discharge by the injectors)
	Clip broken (vibrations, resonance, noises)
	Incorrect state of the electrical pack devices
	Catalytic converter sealed or damaged
	Air inlet circuit open
	Bad flanging of the injector
	Clutch not well set
	Turbo charger damaged
	Valve clearance

SYMPTOM TROUBLESHOOTING GULDE CHART (II)

Check items \ Trouble symtoms	Engine will not start	Engine shut off and then restart	Engine starts only with difficult	High idle no throttle take-up	Knocking on accel. (warm-up phases)	Vibration at idle	Reduced power	Engine does not run smothly, misfiring, knocking	Bucking
Self-diagnosis	1	1	1	1	1	1	1	1	1
Immobilizer	2								
Vehicle supply voltage	3		2					9	3
Main Relay	4	3	3					11	4
Fuse/plug wiring harness	5	2						8	2
Ignition switch signal	6	4	4					10	5
Crankshaft Position Sensor	7							12	
No fuel	8								
Wrong fuel	9	5	7			2	4	3	
Lack of fuel								2	
Air in fuel system	10	6	8			3		4	
Low-pressure circuit (fuel)	11	7	13			4	5	7	
High-pressure circuit (fuel)	16	8	14			14	19	16	
Fuel filter	12		9			5	6	5	
Electric fuel pump	15		11					6	
Fuel pre-heater	13		10			6	7		
Fuel pressure Regulator Valve	18	9	16			13		15	
Incorrect connection of injector	14		17		3	11		13	
Injector	17	10	19		4	10	18	14	
Engine mechanical components (compression, valve clearance...)	19		20				20	19	9
Defective ECM	20								
Camshaft Position sensor			5						
Engine Coolant Temperature Sensor			15		2		15		
Loss of coolant									
Glow-plug system			16						

LWGE001A

Check items \ Trouble symtoms	Engine will not start	Engine shut off and then restart	Engine starts only with difficult	High idle no throttle take-up	Knocking on accel. (warm-up phases)	Vibration at idle	Reduced power	Engine does not run smothly, misfiring, knocking	Bucking
Rail Pressure Sensor	21		18			12	17	17	
Accelerator Position Sensor				2			8		
Mechanical fault in accelerator pedal				3			9		
EGR						7	10		
Mass Air Flow Sensor						9	14		
Air filter clogged			12			8	3		
Vacuum system leaking							2		
Turbocharger defective							11		
Waste-gate valve connection							12		
Fuel Temperature Sensor							16		
Checking timing belt tension								18	
Clutch switch									6
Brake switch									7
Vehicle speed signal									8
Checking oil level									
Radiator fan									
Radiator defective or clogged									
Ignition switch defective									
A/CON compressor switch									
A/CON switch									
Plug contacts			6						
Leak in connecting surface between turbochager and Intake manifold							13		
High pressure pump	22		21				21		

LWGE001B

Check items \ Trouble symtoms	Engine overrun, Accel.	White/Blue smoke	Clouds of black smoke	Engine overheating	Can not shut off with ignition key	Diagnosis lamp not go out or flickers	A/CON cannot be switched on	Radiator fan constantly in operation
Self-diagnosis	1	1	1	1	1	1	1	1
Immobilizer								
Vehicle supply voltage								
Main Relay								
Fuse/plug wiring harness					4	2	2	4
Ignition switch signal					3			
Crankshaft Position Sensor								
No fuel								
Wrong fuel				2				
Lack of fuel								
Air in fuel system		3						
Low-pressure circuit (fuel)		6						
High-pressure circuit (fuel)	7							
Fuel filter		4						
Electric fuel pump								
Fuel pre-heater		5						
Fuel pressure Regulator Valve	6							
Incorrect connection of injector								
Injector								
Engine mechanical components (compression, valve clearance...)			7	7				
Defective ECM					5			
Camshaft Position sensor								
Engine Coolant Temperature Sensor	8	2	6	3			5	3
Loss of coolant				6				
Glow-plug system								

LWGE001C

Check items \ Trouble symtoms	Engine overrun, Accel.	White/Blue smoke	Clouds of black smoke	Engine overheating	Can not shut off with ignition key	Diagnosis lamp not go out or flickers	A/CON cannot be switched on	Radiator fan constantly in operation
Rail Pressure Sensor								
Accelerator Position Sensor	3						6	
Mechanical fault in accelerator pedal	2							
EGR			3					
Mass Air Flow Sensor			5					
Air filter clogged			2					
Vacuum system leaking			4					
Turbocharger defective	4							
Waste-gate valve connection	5							
Fuel Temperature Sensor	9							
Checking timing belt tension								
Clutch switch								
Brake switch								
Vehicle speed signal								
Checking oil level		7						
Radiator fan				4				
Radiator defective or clogged				5				
Ignition switch defective					2			
A/CON compressor switch							4	2
A/CON switch							3	
Plug contacts								
Leak in connecting surface between turbochager and Intake manifold								

LWGE001D

WHEN GLOW(PREHEATING) LAMP IS ILLUMINATED AT ALL TIMES (ECU AUTOMATIC RECONGITION PROCEDURE)

NOTE

1. It is normal if the glow lamp with ignition On is illuminated during preheating(max. 10 seconds) asscording to the ambient temperature and then put off. The glow lamp is illuminated at all times for the vehicle with ECM having not performed automatic recognition procedure.
2. When the customer's complaint arises from glow lamp illumination at all time, if there is no DTC code(P1321) existing, test the ECM by performing ECM Automatic Recognition routine using HI-SCAN.
3. When MT/AT is properly selected, press [ESC] key to stop the automatic recognition.
4. If the ECU is at the initial state, start the automatic recognition routine to adapt the Transaxle type.
5. After adaption, about 5 seconds after with ignition OFF, check whether the adaption is normal or not though glow lamp illumination with ignition ON.
6. Whenever ECM is replaced with a new one or an used one from other transaxle type of vehicle, automatic recognition routine is necessary.

CASE 1) WHEN ECM IS NOT RECOGNIZED IN AT OR MT

Check DTC code using HI-SCAN.
- Is the DTC code P1321 (short circuit of glow lamp) displayed?

YES → Check and repair a short/an open circuit, if necessary

NO ↓

Select the [ECU AT/MT AUTOMATIC RECOGNITION] using HI-SCAN

↓

When it is recognized as the initial state,
- If it displays [Do you want AUTOMATIC RECOGNITION?], select [YES] to start the automatic recognition routine.

↓

When it is recognized as AT instead of MT.
- MT vehicle must not have CAN communication line (ECM pin No.9 and 10) and ECM pin No.56 should not be grounded.
- Repair if the state is not same as the above.

When it is recognized as MT instead of AT.
- AT vehicle must have CAN communication line (ECM pin No.9 and 10) and ECM pin No.56 should be grounded to the body.
- Repair if the state is not same as the above.

↓

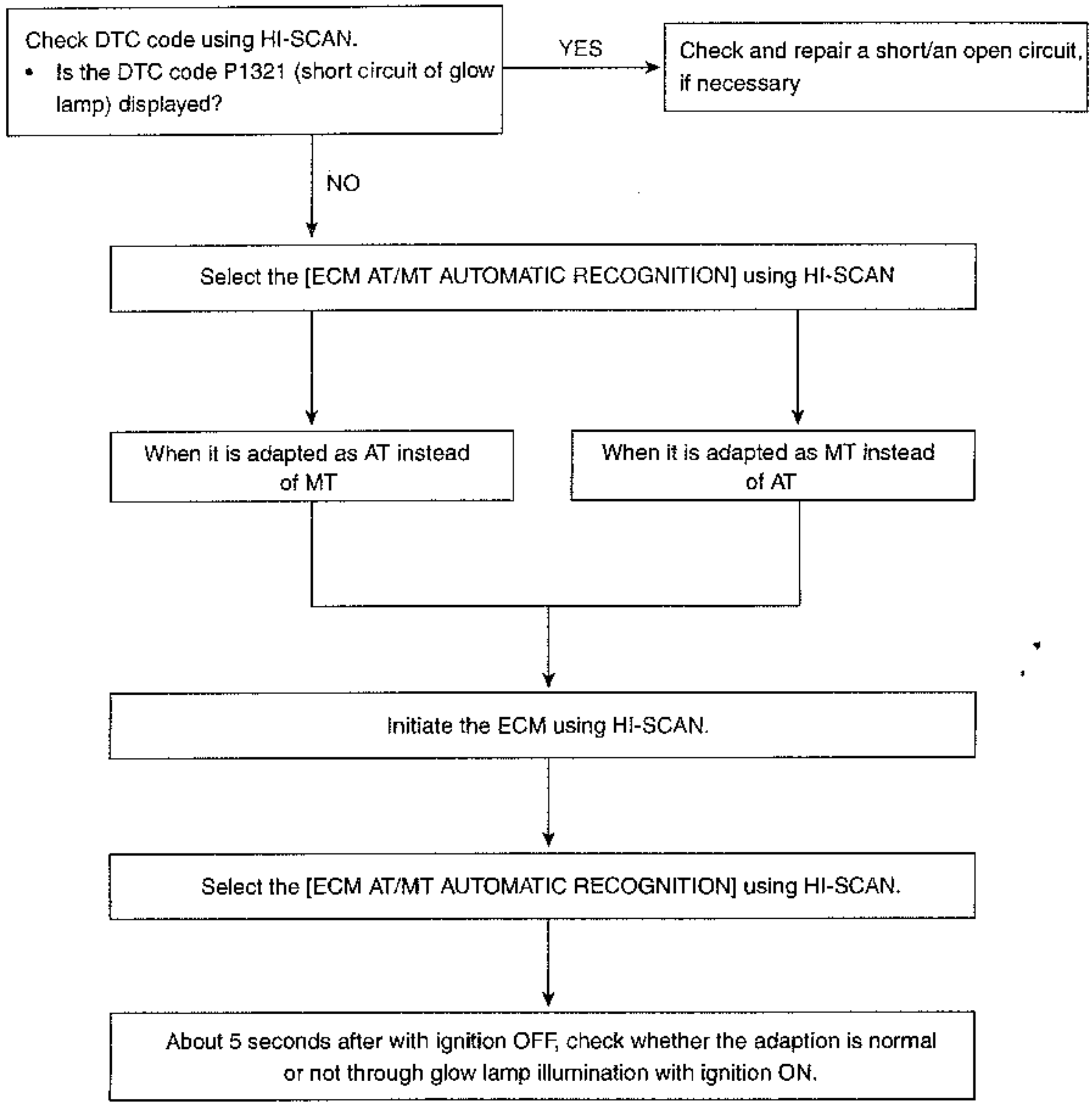
It is normal if it recognizes properly according to transaxle type.
- For MT vehicle : Currently Manual transmission is selected.
- For AT vehicle : Currently Automatic transmission is selected.

↓

About 5 seconds after with ignition OFF, check whether the adaption is completed normally or not through glow lamp illumination with ignition ON.

EFUE409

CASE 2) WHEN ECM INCORRECTLY ADAPTED FOR TRANSAXLE



EFUE410

DIESEL CONTROL SYSTEM

INSPECTION E6D98AFB

If the disel control system components (sensors, ECM, injector, etc.) fail, interruptionto the fuel supply or failure to supply the proper amount of fuel for variousengine operating conditions will result. The following situations may be encountered

1. Engine is hard to start or does not start at all.
2. Nstable idle.
3. Poor driveability.

If any of the above conditions are noted, first perform a routine diagnosis that includes basic engine checks (ignition system malfunction, incorrectengine adjustment, etc.). Then, inspect the disel contorl system components with the HI-SCAN (Pro).

NOTE

- Before removing or installing any part, read the diagnostic trouble codesand then disconnect the battery negative (-) terminal.
- Before disconnecting the cable from battery terminal, turn the ignition switch to OFF. Removal or connection of the battery cable during engine operationor while the ignition switch is ON could cause damage to the ECM.
- Wchecking the generator for the charging state, do not disconnect the battery '+' terminal to prevent the ECM from damage due to the voltage
- Wcharging the battery with the external charger, disconnect the vehicleside battery terminals to prevent damage to the ECM.

SELF-DIAGNOSIS

The ECM monitors the input/output signals (some signals at all times and theothers under specified conditions). When the ECM detects an irregularity, it records the diagnostic trouble code, and outputs the signal to the Data Link connector. The diagnosis results can be read with the MIL or HI-SCAN(Pro). Diagnostic Trouble Codes(DTC) will remain in the ECM as long as battery power is maintained. The diagnostic trouble codes will, however, be erased when the battery terminal or the engine control module(ECM) connector isdisconnected, or by the HI-SCAN (Pro).

NOTE

If a sensor connector is disconnected with the ignition switch turned on, the diagnostic trouble code (DTC) is recorded. In this case, disconnect the battery negative terminal (-) for 15 seconds or more, and the diagnosis memory will be erased.

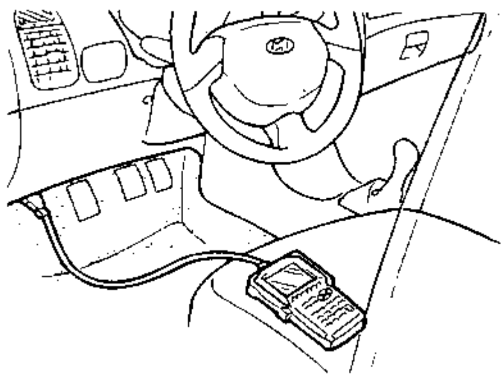
CHECKING PROCEDURE (SELF-DIAGNOSIS)

NOTE

- When attery voltage is excessively low, diagnostic trouble codes can not be read. Be sure to check the battery for voltage and the charging system before starting the test
- Diagnosis memory is erased if the battery or the ECM connector is disconnected. Do not disconnect the battery before the diagnostic trouble codes are completely read and recorded.

INSPECTION PROCEDURE (USING GENERIC SCAN TOOL)

1. Turn OFF the ignition switch.
2. Connect the scan tool to the data link connector on the lower crash pad.
3. Turn ON the ignition switch.
4. Use the scan tool to check the diagnostic trouble code.
5. Repair the faulty part from the diagnosis chart.
6. Erase the diagnostic trouble code.
7. Disconnect the GST.



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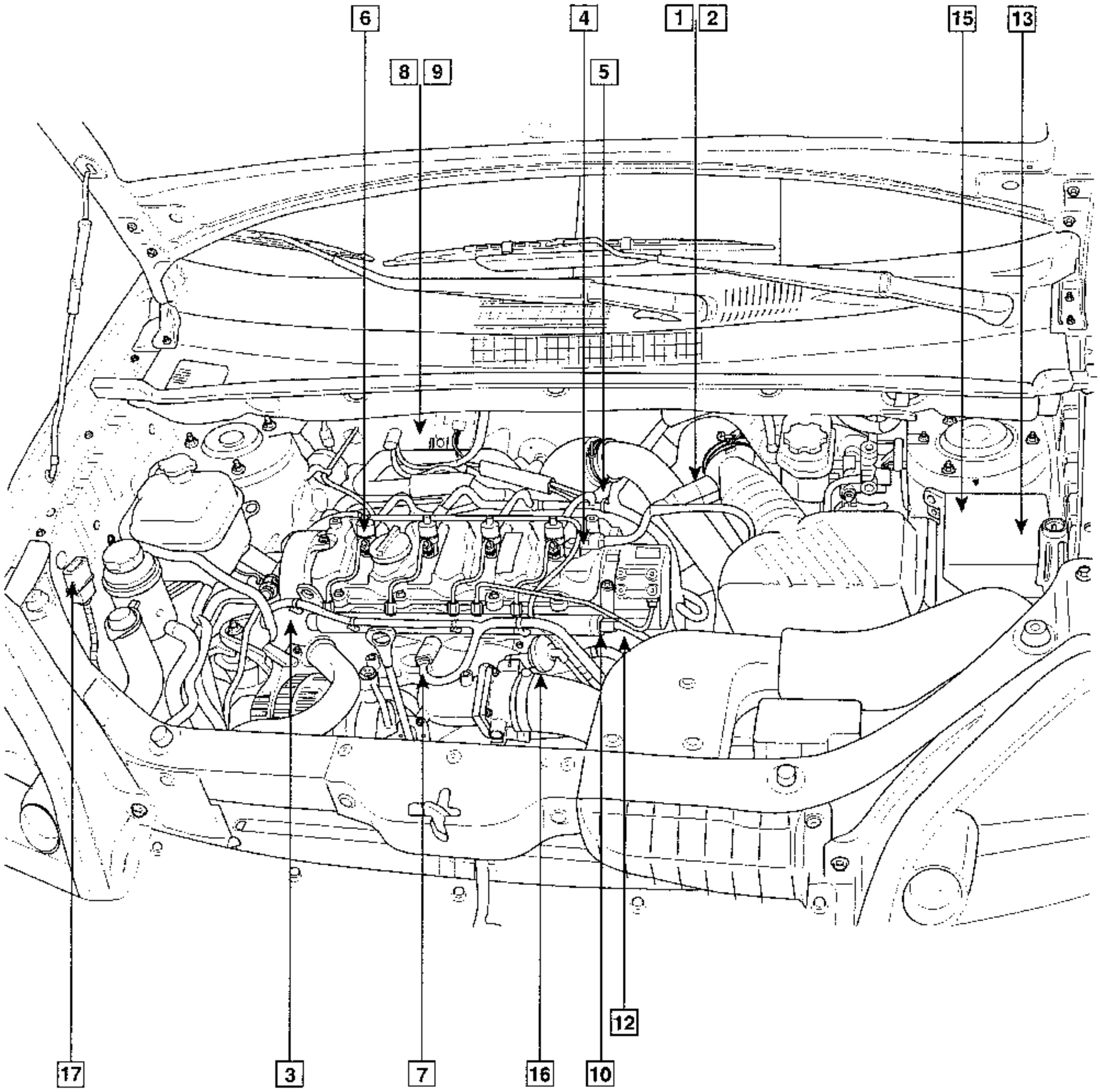
NOTE

When deleting diagnostic trouble code, use scan tool as possible. When deleting diagnostic trouble code by disconnecting battery terminal(-), data for ECM control may delete simultaneously.

COMPONENT LOCATION EC3BEF98



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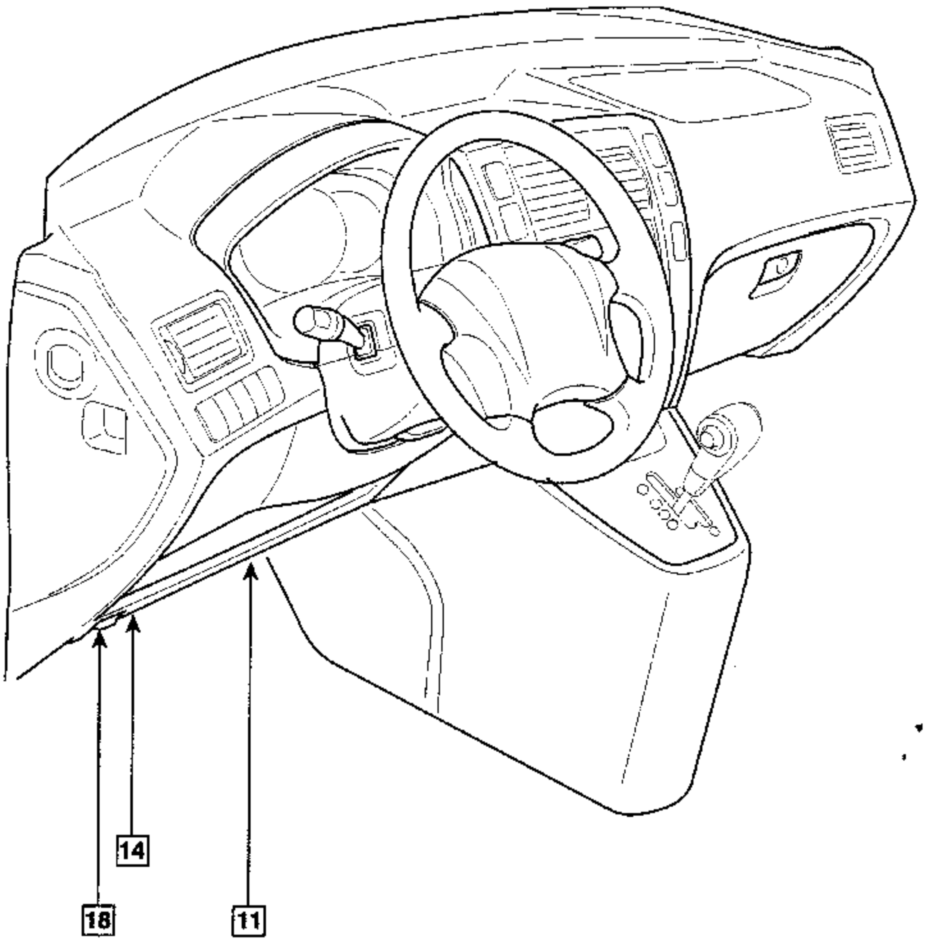
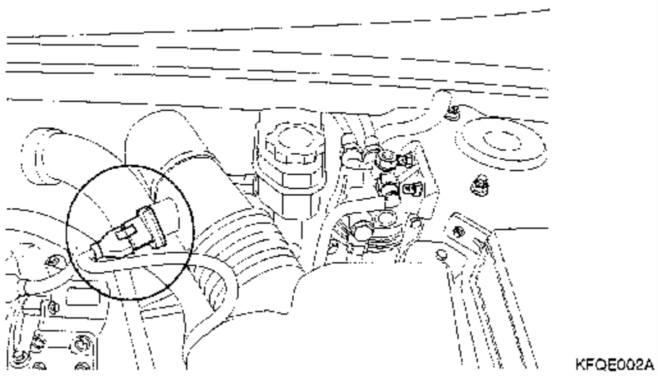


1 Mass Air Flow Sensor (MAFS)
2 Intake Air Temperature Sensor (IATS)
3 Engine Coolant Temperature Sensor (ECTS)
4 Camshaft Position Sensor (CMPS)
5 Crankshaft Position Sensor (CKPS)
6 Injector
7 Rail Pressure Sensor (RPS)
8 Throttle Flap Solenoid Valve
9 EGR Solenoid Valve
10 Fuel Pressure Regulator Valve
11 Accelerator Position Sensor (APS)
12 Fuel Temperature Sensor (FTS)
13 Main Relay
14 ECM
15 Fuel Pump Relay
16 Throttle Flap Actuator
17 Multi-Purpose Check Connector
18 DLC (Data Link Connector)

EFQE001B

1 | 2



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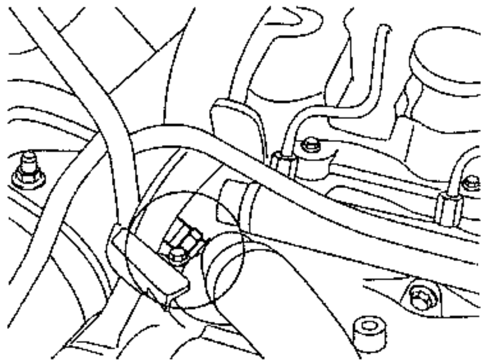

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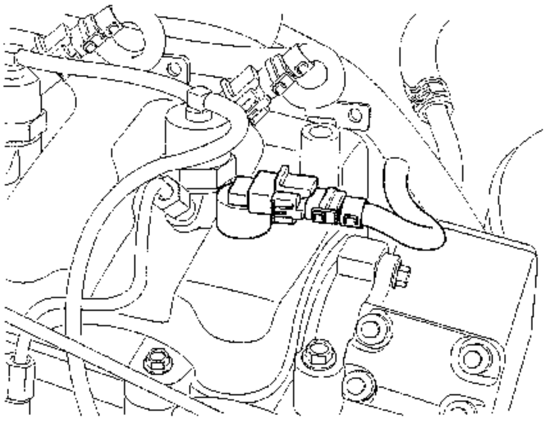

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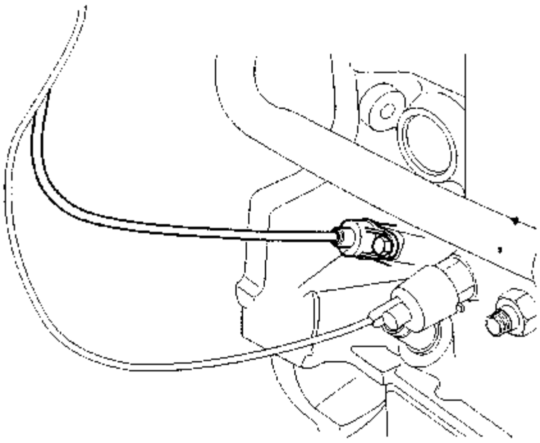

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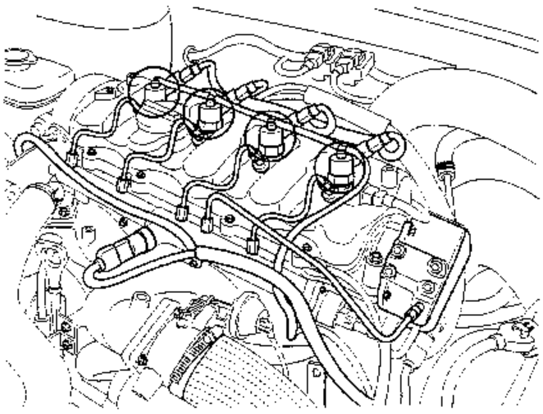

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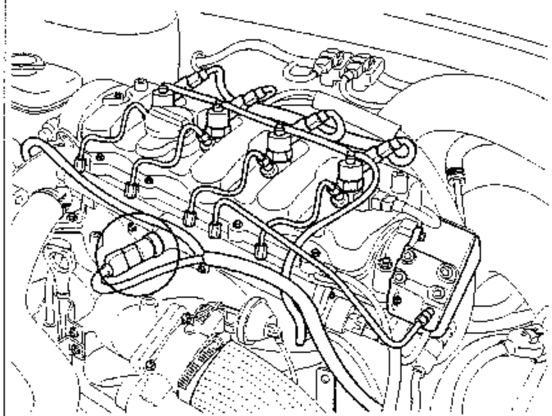

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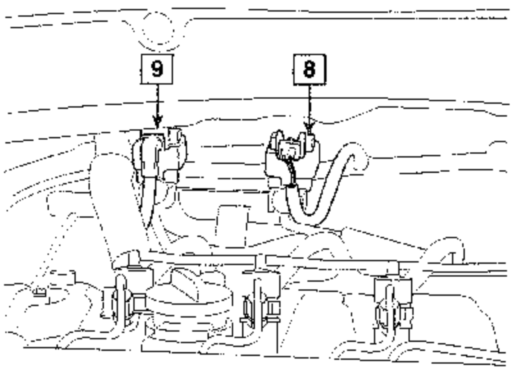
8	9		10	



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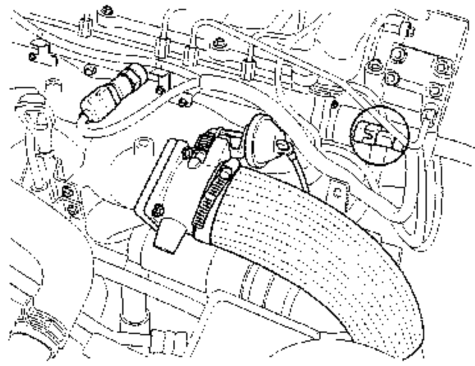

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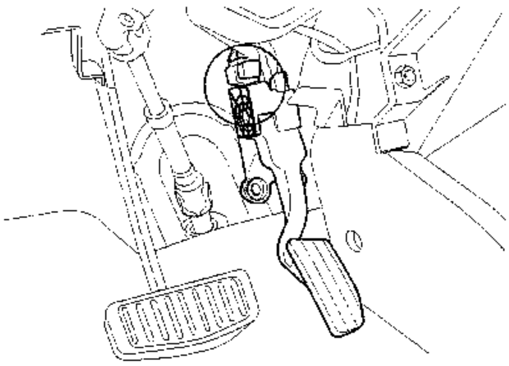
11		12	



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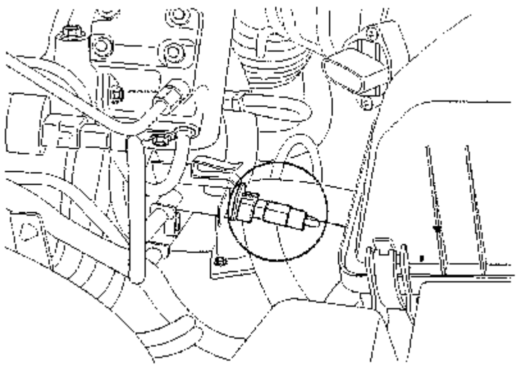

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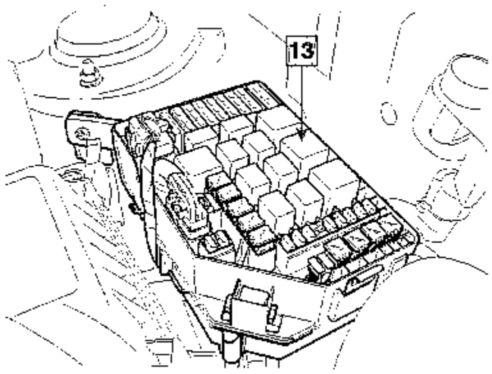
13		14	



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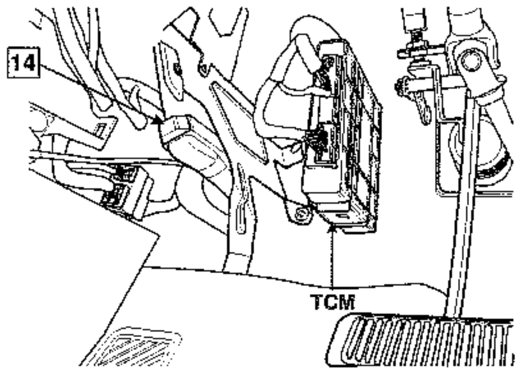

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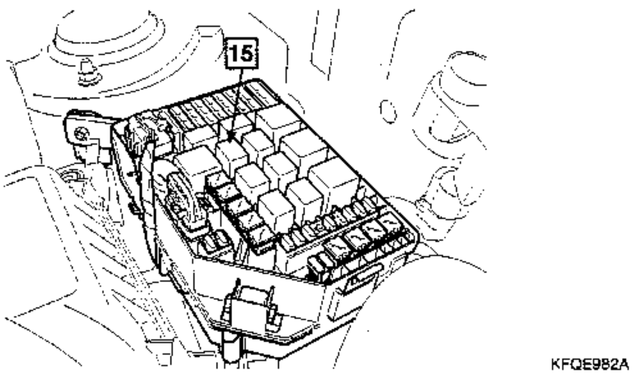
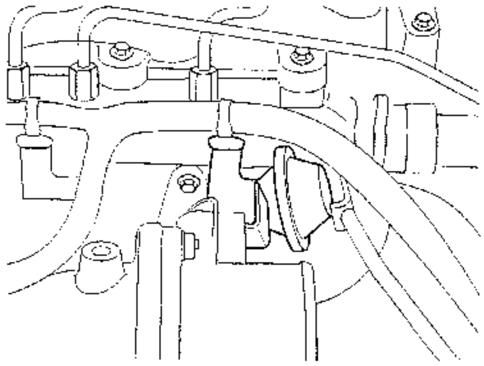
 KFQE982A		 KFQE002L	
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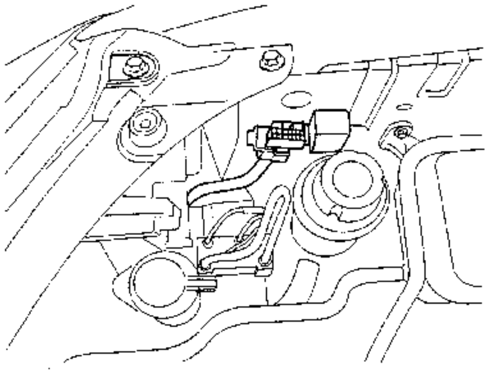
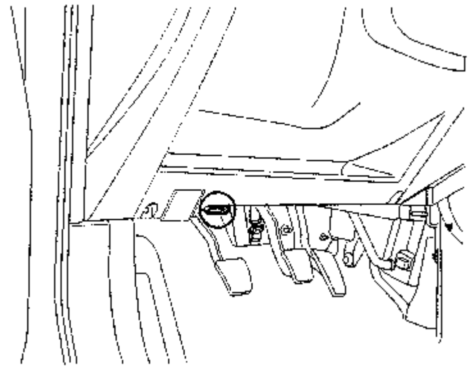
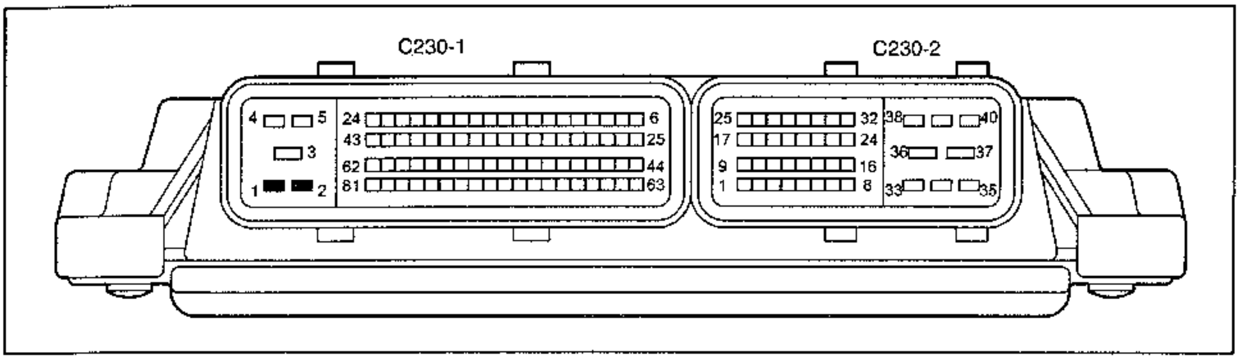
 KFQE002M		 KFQE002N	

ENGINE CONTROL MODULE

ECM CONNECTOR EE6E06F7



[ECM C230-1 CONNECTOR]

PIN	FUNCTION	CONNECTED TO	REMARK
1	Ground	Chassis ground	
2	Ground	Chassis ground	
3	Ground	Chassis ground	
4	Battery Voltage Supply after Main Relay	Main Relay	
5	Battery Voltage Supply after Main Relay	Main Relay	
6	Not connected		
7	Not connected		
8	Not connected		
9	CAN LOW	TCM	A/T Only
10	CAN HIGH	TCM	
11	Immobilizer System	Immobilizer (SMARTRA)	Immobilizer Only
12	Fuel Consumption signal output	Trip Computer	
13	Main Relay control output	Main Relay	
14	Auto Cruise Main Indicator Lamp control putput	Auto Cruise Main Indicator Lamp	Auto Crusie Control System Only
15	Glow Plug Relay control output	Glow Plug Relay	
16	EGR Solenoid Valve control output	EGR Solenoid Valve	
17	Immobilizer Lamp control output	Immobilizer Lamp	Immobilizer Only
18	Throttle Flap Solenoid Valve control output	Throttle Flap Solenoid Valve	
19	Condensor Fan Relay control output (High)	Condensor Fan Relay (High)	
20	Condensor Fan Relay control output (Low)	Condensor Fan Relay (Low)	
21	Air Conditioner Compressor Relay control output	Air Conditioner Compressor Relay	
22	Not connected		
23	Auxiliary Water Heater Relay control output	Auxiliary Water Heater Relay	
24	Electric Fuel Pump Relay control output	Electric Fuel Pump Relay	
25	Not connected		

PIN	FUNCTION	CONNECTED TO	REMARK
26	Not connected		
27	Not connected		
28	Not connected		
29	Not connected		
30	Not connected		
31	Not connected		
32	Not connected		
33	Not connected		
34	Not connected		
35	Not connected		
36	Not connected		
37	Not connected		
38	Not connected		
39	Not connected		
40	Auto Cruise Control Supply	Auto Cruise Control Switch	Auto Cruise Control System Only
41	Not connected		
42	Not connected		
43	Not connected		
44	Not connected		
45	Not connected		
46	Not connected		
47	Engine Speed signal output	Tachometer	
48	Diagnostic Data Line (k-Line)	Data Link Connector (DLC)	
49	Vehicle Speed Sensor (VSS) signal input	Vehicle Speed Sensor (VSS)	
50	Not connected		
51	Air Conditioner Pressure Switch Signal (HIGH/LOW)	Triple Switch	
52	Air Conditioner Pressure Switch Signal (MIDDLE)	Triple Switch	
53	1st Gear Recognition Switch Signal	1st Gear Recognition Switch	
54	Brake Switch Signal 2 (Redundant)	Brake Switch	
55	Not connected		
56	A/T or M/T Auto Recognition Input	M/T: OPEN, A/T: Ground	
57	Not connected		
58	Battery Voltage Supply after Ignition Key	Ignition Key	
59	Brake Switch Signal 1	Brake Switch	
60	Air Conditioner "ON" Signal	Air Conditioner Switch	
61	Clutch Switch Signal (M/T ONLY)	Clutch Switch (M/T ONLY)	
62	Blower Switch Input	Blower Switch	
63	Not connected		

PIN	FUNCTION	CONNECTED TO	REMARK
64	Not connected		
65	Not connected		
66	Not connected		
67	Not connected		
68	Not connected		
69	Not connected		
70	Not connected		
71	Not connected		
72	Not connected		
73	Not connected		
74	Auto Cruise Activator Button Ground	Auto Cruise Control Switch	Auto Cruise Control System Only
75	Auto Cruise Activator Button Signal	Auto Cruise Control Switch	
76	Accelerator Position Sensor (APS) 1 Ground	Accelerator Position Sensor (APS)	
77	Accelerator Position Sensor (APS) 1 Signal Input		
78	Accelerator Position Sensor (APS) 1 Supply		
79	Accelerator Position Sensor (APS) 2 Ground		
80	Accelerator Position Sensor (APS) 2 Signal Input		
81	Accelerator Position Sensor (APS) 2 Supply		

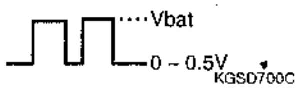
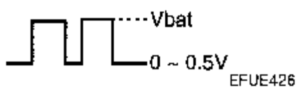
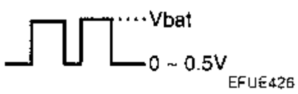
[ECM C230-2 CONNECTOR]

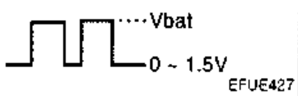
PIN	FUNCTION	CONNECTED TO	REMARK
1	Fuel Temperature Sensor signal input	Fuel Temperature Sensor (FTS)	
2	Fuel Temperature Sensor ground	Fuel Temperature Sensor (FTS)	
3	Engine Coolant Temperature Sensor signal input	Engine Coolant Temperature Sensor (ECTS)	
4	Engine Coolant Temperature Sensor ground	Engine Coolant Temperature Sensor (ECTS)	
5	Intake Air Temperature Sensor input	Intake Air Temperature Sensor (IATS)	
6	Immobilizer Ground	Immobilizer (SMARTRA)	Immobilizer Only
7	Mass Air Flow Sensor ground	Mass Air Flow Sensor (MAFS)	
8	Mass Air Flow Sensor signal input	Mass Air Flow Sensor (MAFS)	
9	Rail Pressure Sensor supply	Rail Pressure Sensor (RPS)	
10	Rail Pressure Sensor signal input	Rail Pressure Sensor (RPS)	
11	Rail Pressure Sensor ground	Rail Pressure Sensor (RPS)	
12	Not connected		
13	Not connected		
14	Not connected		

PIN	FUNCTION	CONNECTED TO	REMARK
15	Not connected		
16	Mass Air Flow Sensor supply	Mass Air Flow Sensor (MAFS)	
17	Not connected		
18	Crankshaft Position Sensor signal input [+]	Crankshaft Position Sensor (CKPS)	
19	Crankshaft Position Sensor signal input [-]	Crankshaft Position Sensor (CKPS)	
20	Crankshaft Position Sensor shield	Crankshaft Position Sensor (CKPS)	
21	Not connected		
22	Camshaft Position Sensor signal input	Camshaft Position Sensor (CMPS)	
23	Camshaft Position Sensor ground	Camshaft Position Sensor (CMPS)	
24	Not connected		
25	Not connected		
26	Not connected		
27	Fuel Pressure Regulator Valve high side	Fuel Pressure Regulator Valve	
28	Fuel Pressure Regulator Valve low side	Fuel Pressure Regulator Valve	
29	Malfunction Indicating Lamp (MIL) output	Malfunction Indicating Lamp (MIL	
30	Glow Time Indicator Lamp control output	Glow Time Indicator Lamp	
31	Not connected		
32	Not connected		
33	Injector (Cylinder 1) low side	Injector (Cylinder 1)	
34	Not connected		
35	Not connected		
36	Injector (Cylinder 1 and 4) high side	Injector (Cylinder 1 and 4)	
37	Injector (Cylinder 2 and 3) high side	Injector (Cylinder 2 and 3)	
38	Injector (Cylinder 4) low side	Injector (Cylinder 4)	
39	Injector (Cylinder 3) low side	Injector (Cylinder 3)	
40	Injector (Cylinder 2) low side	Injector (Cylinder 2)	

ECM PIN CHECK SHEET

[ECM C230-1 CONNECTOR]

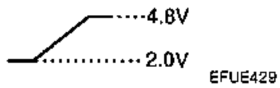
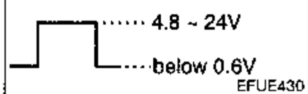
PIN	Pin Description	Vehicle Status	Input/output signal		Note
			Type	Level	
1	Battery minus	All		Ground (0 ~ 0.5V)	
2	Battery minus	All		Ground (0 ~ 0.5V)	
3	Battery minus	All		Ground (0 ~ 0.5V)	
4	Battery plus via Fuse (7,5A)	Ignition ON	DC	Vbatt	
5	Battery plus via Fuse (20A)	Ignition ON	DC	Vbatt	
6	N.A				
7	N.A				
8	N.A				
9	CAN LOW				AT only
10	CAN HIGH				
11	N.A				
12	Fuel consumption signal output	Engine running	Pulse		Fuel 80mcc per 1 pulse
13	System power relay	Ignition ON	DC	Ground (0 ~ 0.5V)	
		Ignition OFF	DC	Vbatt	
14	N.A				
15	Glow relay	Ignition ON (Glow ON)	DC	Ground (0 ~ 0.5V)	
		Ignition ON (Glow OFF)	DC	Vbatt	
16	EGR valve	Engine running	PWM 300HZ		
17	Immobilizer indication lamp	IG. ON (Lamp ON)	DC	Ground (0 ~ 0.5V)	
		IG. ON (Lamp OFF)	DC	Vbat	
18	Throttle flap actuator	2 sec. after engine key OFF	PWN 300HZ		
19	Fan relay - High speed	IG. ON (Fan ON)	DC	Ground (0 ~ 0.5V)	
		IG. ON (Fan OFF)		Vbat	
20	Fan relay - Low speed	IG. ON (Fan ON)	DC	Ground (0 ~ 0.5V)	
		IG. ON (Fan OFF)		Vbat	

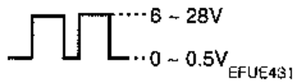
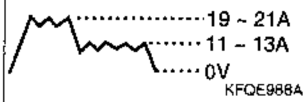
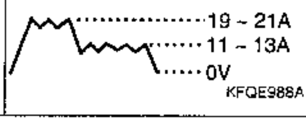
PIN	Pin Description	Vehicle Status	Input/output signal		Note
			Type	Level	
21	A/C compressor relay	Ignition ON (Comp. ON)	DC	Ground (0 ~ 0.5V)	
		Ignition ON (Comp. OFF)	DC	Vbatt	
22	N.A				
23	PTC heater control(or cabin heater relay control)	Engine running (Heater ON)	DC	Ground (0 ~ 0.5V)	PTC heater option only
		Engine running (Heater OFF)	DC	Vbatt	
24	Electric fuel pump relay	In 5 sec.after IG.ON (Relay ON)	DC	Ground (0 ~ 0.5V)	
		In 5 sec.after IG.ON (Relay OFF		Vbatt	
25	N.A				
26	N.A				
27	N.A				
28	N.A				
29	N.A				
30	N.A				
31	N.A				
32	N.A				
33	N.A				
34	N.A				
35	N.A				
36	N.A				
37	N.A				
38	N.A				
39	N.A				
40	Cruise control supply	IG.ON	Analog	4.7 ~ 5.2V	
41	N.A				
42	N.A				
43	N.A				
44	N.A				
45	N.A				
46	N.A				
47	Engine speed output signal	Engnine running	Pluse		
48	Diagnosis - K interface				

PIN	Pin Description	Vehicle Status	Input/output signal		Note
			Type	Level	
49	Vehicle speed sensor signal	Vehicle running	Pluse		
50	N.A				
51	A/C pressure switch signal (Fan speed high)	Engine running (Comp. ON)	DC	Vbatt	
		Engine running (Comp. OFF)		Ground (0 ~ 0.5V)	
52	A/C medium switch input (Fan speed low)	Engine running (Comp. ON)	DC	Vbatt	
		Engine running (Comp. OFF)		Ground (0 ~ 0.5V)	
53	1st gear recognition switch	Ignition ON (1st gear)	DC	Vbat	MT only
		Ignition ON (Other gear)	DC	Ground (0 ~ 0.5V)	
54	Redundant brake switch signal	Ignition ON (Brake Pressed)	DC	Ground (0 ~ 0.5V)	
		Ignition ON (Brake Released)	DC	Vbalt	
55	N.A				
56	MT/AT auto recognition	Ignition ON (MT)	DC	Vbatt	
		Ignition ON (AT)	DC	Ground (0 ~ 0.5V)	
57	N.A				
58	Terminal 15 (switched bat. +)	Ignition ON	DC	Vbalt	
		Ignition OFF	DC	Ground (0 ~ 0.5V)	
59	Brake switch signal	Ignition ON (Brake Pressed)	DC	Vbalt	
		Ignition ON (Brake Released)	DC	Ground (0 ~ 0.5V)	
60	A/C on signal	Ignition ON (A/C SW ON)	DC	Vbalt	
		Ignition ON (A/C SW OFF)	DC	Ground (0 ~ 0.5V)	
61	Clutch switch signal	Ignition ON (Clutch Pressed)	DC	Ground (0 ~ 0.5V)	MT only
		Ignition ON (Clutch Released)	DC	Vbalt	
62	Blower switch input signal	Ignition ON (Blower SW ON)	DC	Ground (0 ~ 0.5V)	
		Ignition ON (Blower SW OFF)	DC	Vbalt	
63	N.A				
64	N.A				

PIN	Pin Description	Vehicle Status	Input/output signal		Note
			Type	Level	
65	N.A				
66	N.A				
67	N.A				
68	N.A				
69	N.A				
70	N.A				
71	N.A				
72	N.A				
73	N.A				
74	Cruise control activator ground	All		Ground (0 ~ 0.5V)	
75	Cruise control activator button signal	IG. ON (Main SW ON)		4300mV ~ 4500mV	
		IG. ON (Set SW ON)		400mV ~ 500mV	
		IG. ON (Resume SW ON)		1300mV ~ 1500mV	
		IG. ON (Cancel SW ON)		Ground (0 ~ 0.5V)	
76	Accelerator pedal sensor 1, ground	All		Ground (0 ~ 0.5V)	
77	Accelerator pedal sensor 1, sign	Ignition ON (Idle)	Analog	0.6 ~ 0.85V	
		Ignition ON (WOT)	Analog	3.5 ~ 4.7V	
78	Accelerator pedal sensor 1, supply	Ignition ON	Analog	5V	
79	Accelerator pedal sensor 2, ground	All		Ground (0 ~ 0.5V)	
80	Accelerator pedal sensor 2, sign	Ignition ON (Idle)	Analog	0.25 ~ 0.51V	
		Ignition ON (WOT)	Analog	1.6 ~ 2.5V	
81	Accelerator pedal sensor 2, supply	Ignition ON		5V	

[ECM C35-2 CONNECTOR]

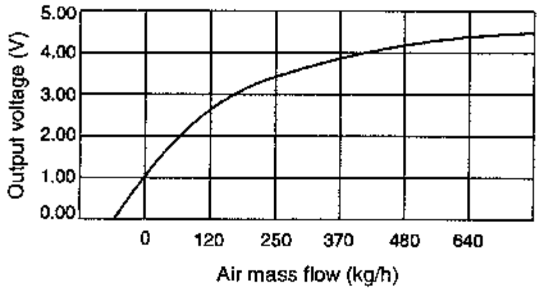
PIN NO.	Pin Description	Vehicle Status	Input/output signal		Note
			Type	Level	
1	N.A				
2	Fuel temp sensor ground	All		Ground (0 ~ 0.5V)	
3	Coolant temperature sensor signal	Ignition ON (below 20°C)	Analog	aboveb 3.5V	
		Ignition ON (below 80°C)	Analog	below 1.8V	
4	Coolant temperature sensor ground			Ground (0 ~ 0.5V)	
5	Air temperature sensor signal	Ignition ON (below 40°C)	Analog	above 1.7V	
		Ignition ON (above 80°C)	Analog	below 0.7V	
6	Immobilizer ground	All		Ground (0 ~ 0.5V)	Immo option only
7	Mass air flow sensor ground	All		Ground (0 ~ 0.5V)	
8	Mass air flow sensor signal	Ignition ON & Engine Warm-up	Analog	545 ~ 605 mg/str	
9	Rail pressure sensor supply	Ignition ON		(5 ± 0.25V)	
10	Rail pressure sensor signal	Ignition ON	Analog		220 ~ 300bar (below 1.5V at idle)
11	Rail pressure sensor ground	All		Ground (0 ~ 0.5V)	
12	N.A				
13	N.A				
14	N.A				
15	N.A				
16	Mass air flow sensor supply	Ignition ON		4.7 ~ 5.2V	
17	N.A				
18	Crankshaft position sensor plus signal	Engine running	Sine wav	Positive peak voltage at idle:minimum 1.65V	
19	Crankshaft position sensor minus signal	Engine running	Sine wav		
20	Crankshaft position sensor shield	All		Ground (0 ~ 0.5V)	
21	N.A				
22	Camshaft position sensor signal	Engine running	Analog		
23	Camshaft position sensor ground	All		Ground (0 ~ 0.5V)	
24	N.A				

PIN NO.	Pin Description	Vehicle Status	Input/output signal		Note
			Type	Level	
25	N.A				
26	N.A				
27	Rail pressure regulator "high side" (MPROP)	Engine running	PWM 1KHZ	 	
28	Rail pressure regulator "low side" (MPROP)	Engine running	PWM 1KHZ		
29	Malfunction indication lamp	Ignition ON (Lamp ON)	DC	Ground (0 ~ 0.5V)	
		Ignition ON (Lamp OFF)	DC	Vbatt	
30	Glow indication lamp	Ignition ON (Lamp ON)		Ground (0 ~ 0.5V)	
		Ignition ON (Lamp OFF)		Vbatt	
31	N.A				
32	N.A				
33	Injector for cylinder 1	Engine running	Analog	 	
34	N.A				
35	N.A				
36	Injector "high bank" (cyl. 1 and 4)	Engine running	DC	10 Volt or more	
37	Injector "high bank" (cyl. 2 and 3)	Engine running	DC	10 Volt or more	
38	Injector for cylinder 4	Engine running	Analog	 	
39	Injector for cylinder 3				
40	Injector for cylinder 2				

AIR FLOW SENSOR (MAF & IAT)

AIR FLOW SENSOR (AFS) EBEEDC0B

MAF uses the features of sensor heater, after HOT FILM units calculate the intake air quantity, then send the signal to ECM. ECM uses the signal to decide the timing for EGR operation.



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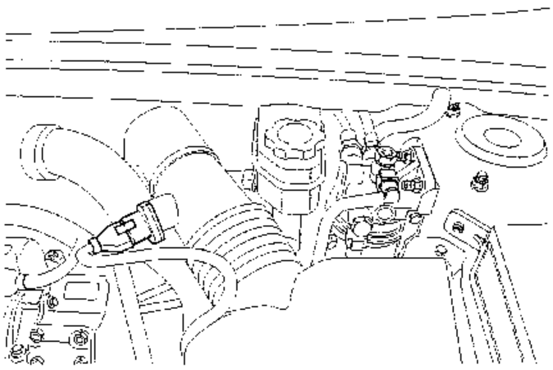

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HOT FILM AFS OUTPUT FEATURES

Mass air flow (kg/h)	Output voltage (V)
8	1.19 ~ 1.20
10	1.25 ~ 1.27
15	1.39 ~ 1.42
30	1.75 ~ 1.78
60	2.22 ~ 2.27
120	2.79 ~ 2.85
250	3.51 ~ 3.58
370	3.94 ~ 4.00
480	4.24 ~ 4.32

TROUBLESHOOTING HINTS

1. When Ignition switch is turned on, if AFS output voltage is not "0" (engine stops), inspect the malfunction of AFS and ECM.
2. Even though AFS output voltage is abnormal, if engine is at idle, inspect the following conditions.
   1) Chect the poor attachment of airflow, cut air duct, and air cleaner filter branched from AFS.
   2) Bad combustion in the cylinder or fault injector
3. Even if no AFS malfunction occurs, check the mounting dircection of AFS.

NOTE

- Use correct digital voltmeter.
- Before inspection, warming up the engine till the engine coolant temperature is up to 80° ~ 90°C-.

WIRING HARNESS INSPECTION

Refer to P0102, P0103 DTC inspection procedures.

AIR TEMPERATURE SENSOR(ATS)

AIR TEMPERATURE SENSOR (ATS) EF64B01B

SENSOR INSPECTION

1. Inspect the resistance of sensor using a multi-tester.
2. Measure teh resistance between ATS and terminal

CONDITION	TEMPERATURE (°C)	RESISTANCE (kΩ)
Ignition ON	-40	39.260
	-30	22.260
	-20	13.850
	-10	8.609
	0	5.499
	+10	3.604
	+20	2.420
	+30	1.662
	+40	1.166
	+50	0.835
	+60	0.609
	+70	0.452
	+80	0.340
	+90	0.261
	+100	0.202
	+110	0.159
	+120	0.127
	+130	0.102

3. If resistance value is out of standard, replace the intake air temperature sensor is integrated in AFS.

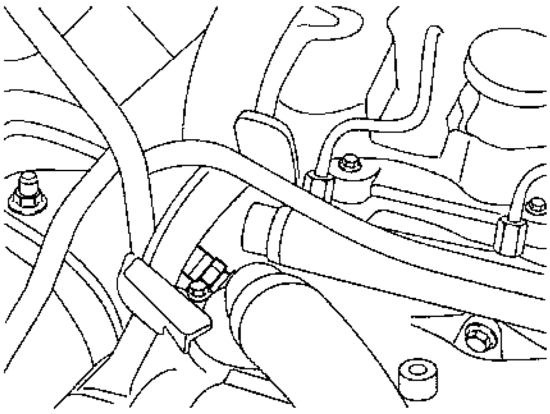
WIRING HARNESS INSPECTION

Refer to P0112, P0113 DTC inspection procedures.

ENGINE COOLANT TEMPERATURE SENSOR (ECT)

ECTS (ENGINE COOLAANT TEMPERATURE SENSOR) E1A1CFAD

The engine coolant water temperature sensor is located in the engine coolant passage of the cylinder head. It detects the water teperature and relays signals to the ECM. It employs a thermistor, which is sensitive to changes in temperature. The electric resistance of a thermistor decreases in response to temperature rise. The ECM judges engine coolant temperture by the sensor output voltage and provides optimum fuel enrichment when the engine is cold.



KFQE060A

TROUBLESHOOTING HINTS

When idling speed is not appropriate or blacksmoke arises it is likely to be a defect of water temperature sensor.

WIRING HARNESS INSPECTION

Refer to P0117, P0118 DTC inspection procedures.

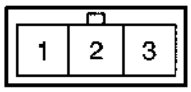
USING MULTITESTER

1. Remove the water temperature sensor from the engine coolant passage of the cylinder head.
2. With the temperature sensing portion of the engine coolant temperature sensor immersed in hot water, check resistance.
   1) WTS sensor (check pin : terminal 1 and 2)

Temperature (°C)	Resistance (kΩ)
-40	48.14
-20	14.13 ~ 16.83
0	5.790
20	2.31 ~ 2.59
40	1.148
60	0.59
80	0.32
100	0.19
110	0.14 ~ 0.15
120	0.1163

   2) Gauge nuit (check pin : terminal 2 and 3)

Temperature (°C)	Resistance (kΩ)
60	125
85	42.6 ~ 54.2
110	22.1 ~ 26.2
125	15.2



Pin NO.	Description
1	ECTS signal
2	Signal for gauge
3	ECTS ground

EFQE005E

3. If the resistance deviates from the standard value greatly, replace the sensor.

INSTALLATION

1. Apply aealant THREE BOND TB 2403 or equivalent to threaded portion.

2. Install water temperature sensor and tighten it to specified torque.

Tightening torque
20 ~ 40 N·m (14.75 ~ 29.50 lb·ft)

3. Connect the harness connector securely.

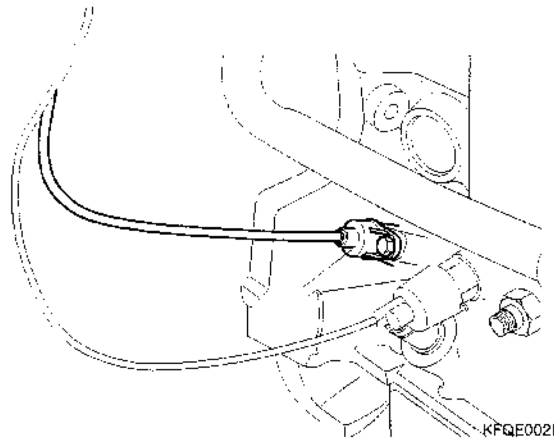
4. After running engine, check coolant leak.

CRANKSHAFT POSITION SENSOR (CKP)

CRANSHAFT POSITION SENSOR (CKP)

EDC466BC

Piston position on combustion chamber is the substantial to define the starting of injection timing. All engine pistons are connected to crankshaft by connecting rod. Sensor on crankshaft can supply the informations concerning all piston positions, revolution speed is defined by revolution per minute of crankshaft. The signal induced from crankshaft position sensor is sent to ECM.

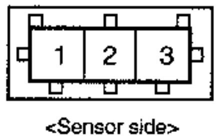


KFQE002D

SENSOR INSPECTION

1. Remove CKP sensor.
2. Measure resistance between the terminals 1 and 2

Resistance : 0.77 ~ 0.95 kΩ (20°C)



Pin NO.	Description
1	Sensor shield
2	CKPS signal(-)
3	CKPS signal(+)

EFQE005D

3. Measure the gap between CKP sensor and sensor wheel.

Gap : 0.5 ~ 1.5 mm

4. Install CKP sensor.

Tightening torque: 3.9 ~ 5.9 N·m (2.9 ~ 4.35 lb·ft)

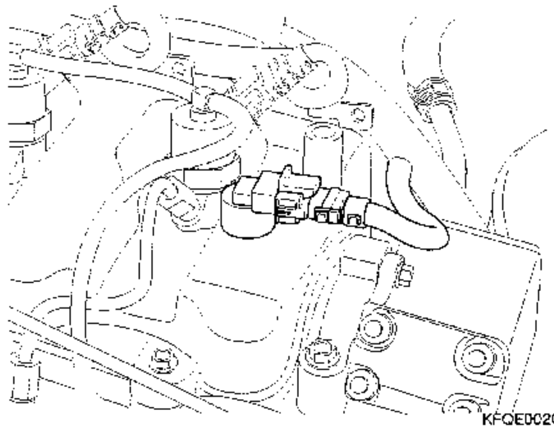
WIRING HARNESS INSPECTION

Refer to P0336 DTC inspection procedures.

CAMSHAFT POSITION SENSOR (CMP)

CAMSHAFT POSITION SENSOR (TDC) EA5523BF

TCD sensor senses the TDC sensor(Camshaft Position Sensor) point of ON.1, 4 cylinder on its compression stroke. Its signal is fed to ECM to be used to determine the sequence of fuel injection. Crank angular sensor senses the crank angular of each cylinder, and input the pulse signal to ECM. Its signal is fed to ECM to be used to determine the engine speed and adjust the fuel injection timing and ignition timing.



KFQE002C

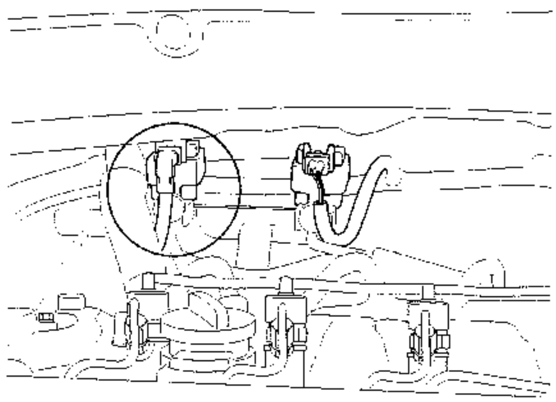
WIRING HARNESS INSPECITON

Refer to P0341, P0343 DTC inspection procedures.

EGR SOLENOID VALVE

EGR SOLENOID VALVE EE4B9AC0

With exhaust-gas recirculation (EGR) a portion of the exhaust gas is led into the engine's intake tract. Up to a certain degree, an increasing portion of the residual exhaust gas content has a positive affect upon the exhaust-gas emissions. For ECM control, the actual drawn-in fresh-air mass is measured and compared at each operating point with the air mass setpoint value. Using the signal generated by the control circuit, the ECG valve opensso that exhaust gas can flow into the intake tract.



KFQE080A

WIRING HARNESS INSPECTION

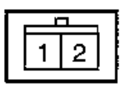
Refer to P0405, P0406 DTC inspection procedures.

EGR SOLENOIDD VALVE INSPECTION

Check item	Check condition (Using Hi-scan(pro)	Engine condition	Standard value
EGR solenoid valve	Solenoid valve OFF → ON	Ignition switch : ON	Check the sound for proper operation

VALVE INSPECTION

Measure resistance between the terminals 1 and 2.



<Solenoid side>

Pin NO.	Description
1	Solenoid power
2	Solenoid control

EFQE005C

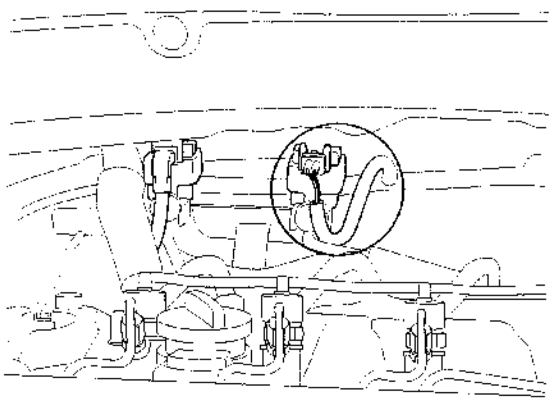
Check item	Specified value
EGR solenoid valve resistance	14 ~ 17Ω

THROTTLE CONTROL

THROTTLE FLAP SOLENOID VALVE

EC26EE4D

In order to decrease engine vibration and noise at engine stop ECM operates throttle flap solenoid valve to open and vacuum from alternator let the actuator operated to close the throttle flap for a moment.



KFQE080B

WIRING HARNESS INSPECTION

Refer to P0405, P0406 DTC inspection procedures.

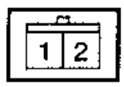
THROTTLE FLAP SOLENOID VALVE INSPECTION

Check item	Check condition (Using Hi-scan(pro)	Engine condition	Standard value
Throttle flap solenoid valve	Solenoid valve OFF → ON	Ignition switch : ON	Check the sound for proper operation

VALVE INSPECTION

Measure resistance between the terminals 1 and 2.

Check item	Specified value
Throttle flap solenoid valve resistance	14 ~ 17Ω



<Solenoid side>

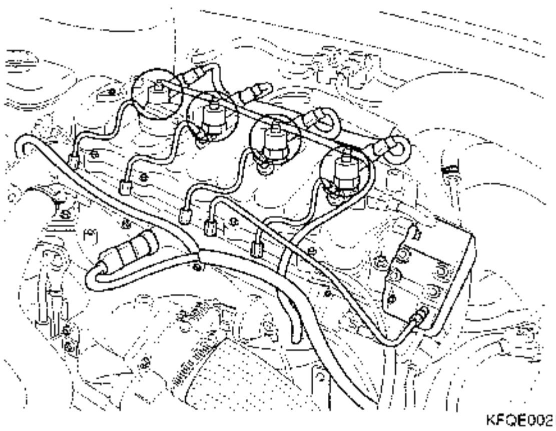
Pin NO.	Description
1	Solenoid power
2	Solenoid control

EFQE005B

RAIL PRESSURE SENSOR (RPS)

RAIL PRESSURE SENSOR (RPS) EBB4C6E6

In order to output a voltage signal to the ECM which corresponds to the applied pressure, the rail pressure sensor must measure the instantaneous pressure in the rail. The fuel flows to the rail pressure sensor through an opening in the rail, the end of which is sealed off by the sensor diaphragm. Pressurized fuel reaches the sensor's diaphragm through a blind hole. The sensor element (semiconductor device) for converting the pressure to an electric signal is mounted on this diaphragm. The signal generated by the sensor is inputted to an evaluation circuit which amplifies the measuring signal and sends it to the ECM.



KFQE002E

USING HI-SCNA

Check item	Data display	Check conditions	Rail pressure	Set value (HI-SCAN)
Rail pressure sensor	Rail pressure	Engine at idle	220 ~ 300 bar	260bar

WIRING HARNESS INSPECTION PROCEDURES

Refer to P0190, P0192, P0193 DTC inspection procedures.

SENSOR REPLACEMENT

Replace the RPS if signal voltage exceeds the ste value

Tightening torque
33 ~ 37 N·m (24.34 ~ 27.29 lb·ft)

CAUTION

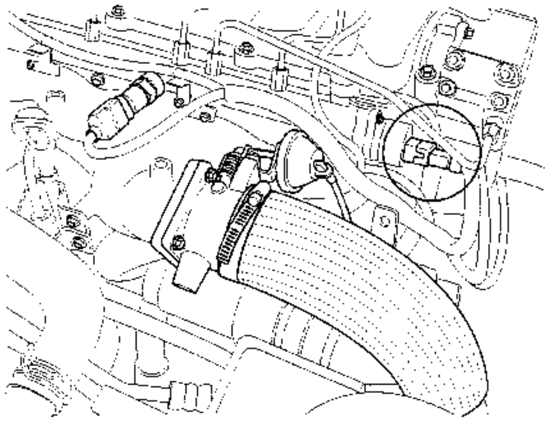
1. Always renew the sealing washer (soft iron sealing ring) even if old sensor is re-used.
2. When removing seal, take care not to damage sealing surface.
3. When installing RPS, provide the sealing washer with grease if necessary.

RAIL PRESSURE CONTROL VALVE

RAIL PRESSURE REGULATOR (MPROP)

EE4D948A

The rail pressure-control valve sets the correct pressure in the rail as a function of engine loading, and maintains it at this level. If the rail pressure is excessive, the pressure--control valve opens and a portion of the fuel returns from the rail to the fuel tank via a collector line. If the rail pressure is too low, the pressure-control valve closes and seals off the high-pressure stage from the low-pressure stage. Rail pressure control valve is intgrated in high-pressure pump.



KFQE070A

TROUBLESHOOTING HINTS

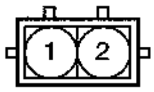
At after run test mode or fuel cut mode, if within set time engine rpm is not dropped below the lower set value, error is detected. The reasons are short circuit, connecting resistance, faulty rail pressure sensor, continuity of fuel pump relay, faulty rail pressure control valve, defective high pressure pump, ECU fault, etc.

WIRING HARNESS INSPECTION

Refer to P1182, P1183 DTC inspection procedures.

RAIL RPRESSURE CONTROL VALVE INSPECTION USING VOLTMETER

Check item	Set value (Ω)
Rail pressure contorl Valve resistance	2.07 ~ 2.53Ω



<Valve side>

Pin NO.	Description
1	MPROP High press. side
2	MPROP Low press. side

EFQE005F

ACCELERATION POSITION SENSOR (APS)

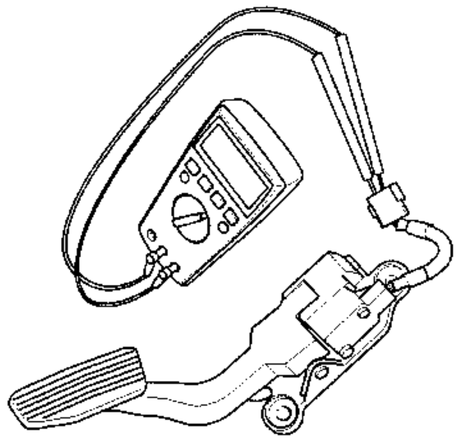
ACCELERATION PEDAL POSITION SENSOR (APS)

EBCBDB91

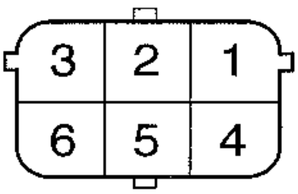
APS senses the driver's acceleration input and sends it to ECM. Using the signal, ECM decides the fuel injection quantity and ignition timing.

SENSOR INSPECTION

1. Connect voltmeter to the terminals 1 and 4 of APS1 connector.



KFQE004A



<Harness connector>

EFSD038B

2. Supply the terminal 3 with DC 5V.
3. Check the voltage between the terminals 1 and 4.

Idle : 0.7 ~ 0.8V
WOT : 3.8 ~ 4.4V

4. Disconnect the voltmeter and supply the terminal 6 with DC 5V.
5. Connect voltmeter(B) to the terminals 2 and 5 of APS2 connector(A).
6. Check the voltage between the terminals 2 and 5.

Idle : 0.27 ~ 0.48V
WOT : 1.75 ~ 2.35V

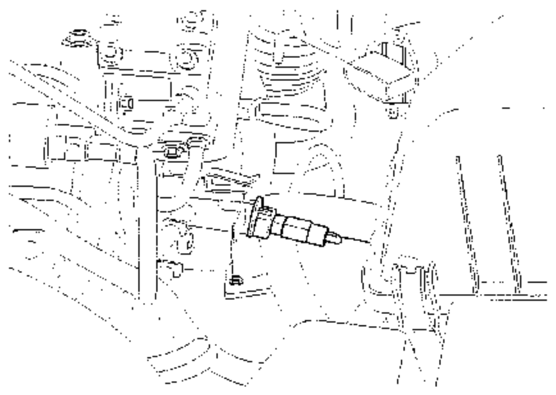
WIRING HARNESS INSPECTION

Refer to P0120, P0123, P0220, P0223, P2135 DTC inspection procedures.

FUEL TEMPERATURE SENSOR (FTS)

FUEL TEMPERATURE SENSOR E68FE9FD

The fuel temperatur sensor (FTS) senses fuel temperature and send it to ECM. Using the signal, ECM decides the fuel injection quantity.



KFQE090A

TROUBLESHOOTING HINTS

When idling speed is not appropriate or blacksmoke arises it is likely to be a defect of fuel temperature sensor.

WIRING HARNESS INSPECTION

Refer to P0182, P0183 DTC inspection procedures.

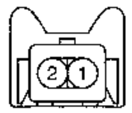
USING MULTITESTER

1. Remove the fuel temperature sensor.

2. With the temperature sensing portion of the fuel temperature sensor immersed in hot water, check resistance.

FTS SENSOR (CHECK PIN : TERMINAL 1 AND 2)

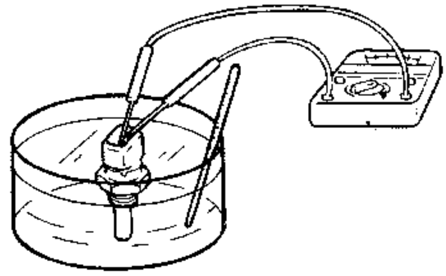
Temperature(°C)	Resistance (kΩ)
-40	48.14
-20	14.13 ~ 16.83
0	5.790
20	2.31 ~ 2.59
40	1.148
60	0.59
80	0.32
100	0.19
110	0.14 ~ 0.15
120	0.1163



<Sensor side>

Pin NO.	Description
1	Sensor ground
2	FTS signal

EFQEC05A



EFUE436

3. If the resistance deviates from the standard value greatly, replace the sensor.

INSTALLATION

1. Apply sealant THREE BOND TB 2403 or equivalent to threaded portion.

2. Install fuel temperature sensor and tighten it to specified torque.

Tightening torque
20 ~ 40 N·m (14.75 ~ 29.50 lb·ft)

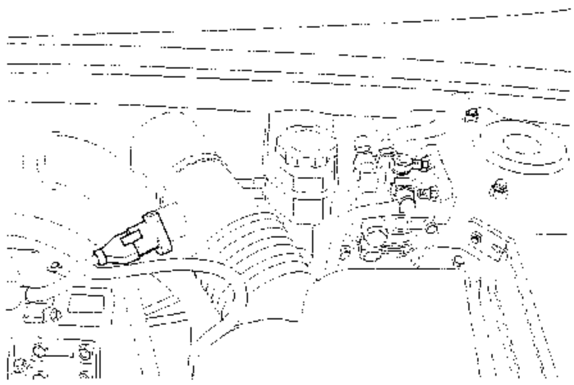
3. Connect the harness connector securely.

4. After running engine, check fuel leak.

DTC TROUBLESHOOTING PROCEDURES

DTC P0100 | MASS OR VOLUME AIR FLOW CIRCUIT

COMPONENT LOCATION EA1BAE0C



P0100-1

DESCRIPTION EDBBD4A8

GENERAL DESCRIPTION

MAFS (Mass Air Flow Sensor) has a built-in intake air temperature sensor and is located between the air cleaner assembly and the throttle device. The MAFS uses a hot film type sensing-element to measure the mass of intake air entering the engine. And send the signal to ECM.

A large amount of intake air represents acceleration or high load conditions while a small amount of intake air represents deceleration or idle.

The ECM uses this information to control the EGR solenoid valve and correct the fuel amount.

DTC DESCRIPTION

If the signal exceeds threshold value, the ECM judges this as a fault and DTC is set.

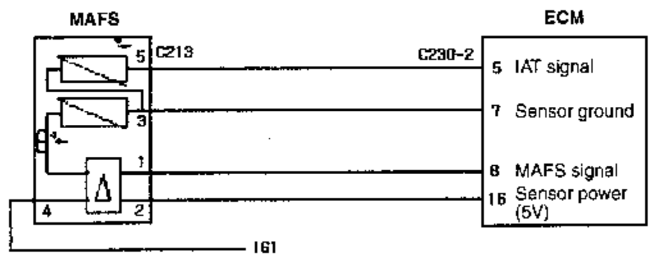
DTC DETECTING CONDITION E1B0BBA9

Item	Detecting Condition	Possible Cause
DTC Strategy	• Voltage range check	• Short to battery in signal circuit • Short to battery in power circuit • Faulty MAFS • Faulty ECM
Enable Conditions	• Engine run	
Threshold Value	• 4.7 V < Sensor supply voltage < 5.1 V	
Diagnostic Time	• 0.1 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• Yes • Yes • No • Yes	
Fail safe	• EGR valve deactivited • Fuel quantity limitation	

SPECIFICATION EFFC1F25

MAFS	Idle Position (without EGR)	Idle Position (with EGR)
Mass air flow	450~550 mg/stroke	280~360 mg/stroke

SCHEMATIC DIAGRAM E2BEC634



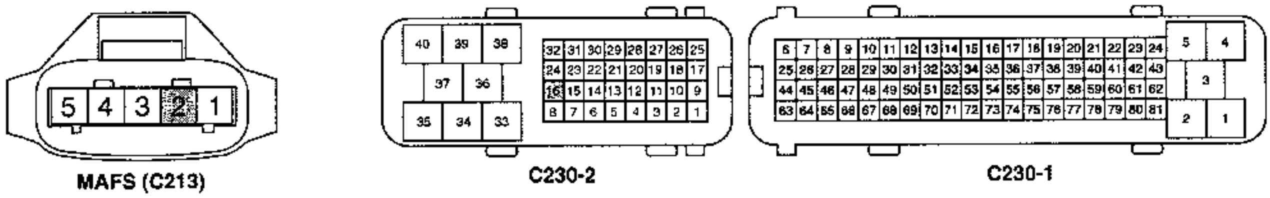
[Connection Information]

1	C230-2 Terminal 8	MAFS signal
2	C230-2 Terminal 16	Sensor power
3	C230-2 Terminal 7	Sensor ground
4	IG1	IG1 Power
5	C230-2 Terminal 5	IAT Signal

[CONNECTOR]

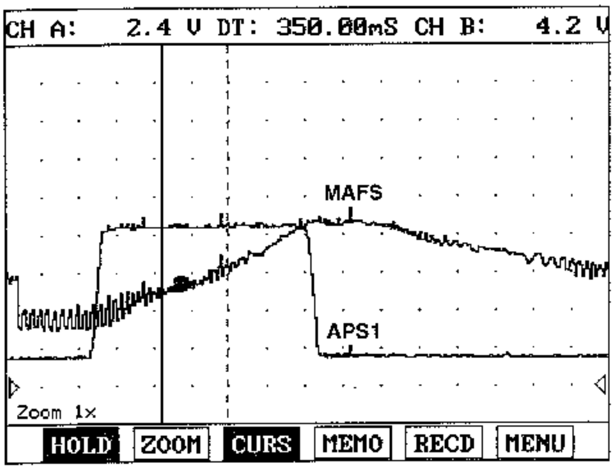
MAFS Harness side connector

ECM side terminal



E0100-2

SIGNAL WAVEFORM E738ACC9



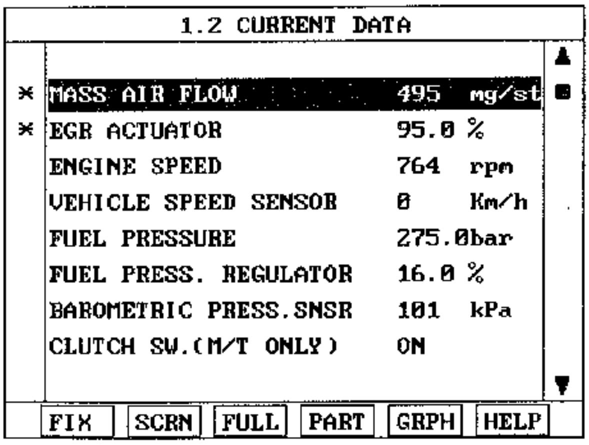
This test should be inspected after depressing the HOLD mode from run during the sudden acceleration.
As accel pedal with the MAFS is pressed down fully, the intensity of the waveform increases from less than 1V to over 4V.
The waveform pattern become increasing upward rapidly when the engine speed increases.
If the waveform pattern becomes distorted after the sudden acceleration, replace the MAFS.

FQ100-3

MONITOR SCANTOOL DATA EC25E14F

1. Connect scantool to Data Link Cable (DLC).
2. Warm up engine to normal operating temperature.
3. Monitor that " Mass Air Flow Sensor " parameter on the scantool is changing without EGR actuator operation or without EGR actuator operation while idling engine speed.

FIG 1



1.2 CURRENT DATA

*	MASS AIR FLOW	495	mg/st
*	EGR ACTUATOR	95.0	%
	ENGINE SPEED	764	rpm
	VEHICLE SPEED SENSOR	0	Km/h
	FUEL PRESSURE	275.0	bar
	FUEL PRESS. REGULATOR	16.0	%
	BAROMETRIC PRESS.SNSR	101	kPa
	CLUTCH SW.(M/T ONLY)	ON	

FIX SCRN FULL PART GRPH HELP

FIG 2

1.2 CURRENT DATA			
*	MASS AIR FLOW	311	mg/st
*	EGR ACTUATOR	40.8	%
	ENGINE SPEED	760	rpm
	VEHICLE SPEED SENSOR	0	Km/h
	FUEL PRESSURE	278.7	bar
	FUEL PRESS. REGULATOR	16.2	%
	BAROMETRIC PRESS.SNSR	101	kPa
	CLUTCH SW.(M/T ONLY)	ON	

FIX | SCRN | FULL | PART | GRPH | HELP

Fig 1) Normal value without EGR actuator : Approx. 450 ~ 550 mg/stroke

Fig 2) Normal value with EGR actuator : Approx. 280 ~ 360 mg/stroke

Is the current data displayed correctly ?

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "W/Harness Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION EEE2F9C3

1. Many malfunctions in the electrical system are caused by poor harness and terminals.

   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

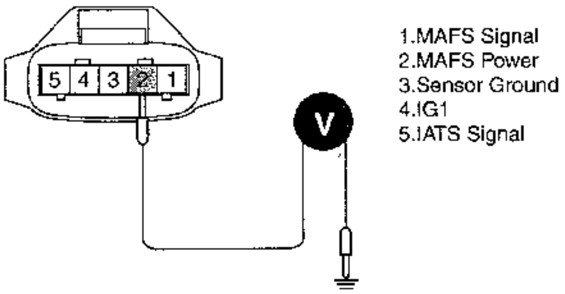
Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION EAA617D1

1. Check for short in harness.
   1) Ignition "OFF".
   2) Disconnect MAF sensor connector.
   3) Ignition "ON" & Engine "OFF".
   4) Measure voltage between terminal "2" of the sensor harness connector and chassis ground.

   Specification : 4.8V ~ 5.1V

[C-231]



   5) Is the measured voltage within specifications ?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Check for short to battery or ground in the MAFS power harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E5ADE45E

1. Visual Inspection
   1) Ignition "OFF" & Engine "OFF".
   2) Check that arrow mark on the MAFS is indicating correct direction.
   3) Check any contamination, corriosion or damage on connector.
   4) Check that air cleaner is clogged or wet.
   5) Check that MAFS cylinder is deformed, blocked by any foreign material or contaminated.

   NOTE

   Hot film can be seriously damaged by foreign material or moisture.

   6) Is the MAFS visually O.K ?

YES

▶ Go to "Check MAFS" as below.

NO

▶ Substitute with a known-good MAFS and check for proper operation.
If the problem is corrected, replace MAFS and then go to "Verification of Vehicle Repair" procedure.

2. Check MAF.
   1) Engine "ON".
   2) Warm up the engine to normal operating temperature.
   3) Check any leakage on intake system(Leakage or damage on intercooler hose).
   4) Check that EGR operates after sudden accelleration elasped around 90 sec.
      If necessary, disconnect EGR vaccum hose.
   5) Monitor "MASS AIR FLOW" parameter on the CURRENT DATA.

Specification : 500mg/st ± 50mg/st

1.2 CURRENT DATA		
* MASS AIR FLOW	495	mg/st
* EGR ACTUATOR	95.0	%
ENGINE SPEED	764	rpm
VEHICLE SPEED SENSOR	0	Km/h
FUEL PRESSURE	275.0	bar
FUEL PRESS. REGULATOR	16.0	%
BAROMETRIC PRESS.SNSR	101	kPa
CLUTCH SW.(M/T ONLY)	ON	

FIX SCRN FULL PART GRPH HELP

   6) Is the current data displayed correctly ?

YES

▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Substitute with a known-good MAFS and check for proper operation.
If the problem is corrected, replace MAFS and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E8AC3B67

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle within DTC Enable conditions in General information.
3. Are any DTCs present ?

YES

Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

DTC P0101 | MASS OR VOLUME AIR FLOW CIRCUIT RANGE/PERFORMANCE PROBLEM

COMPONENT LOCATION E55A597A

Refer to DTC P0100.

DESCRIPTION EB115E8B

GENERAL DESCRIPTION

Refer to DTC P0100

DTC DESCRIPTION

If the signal exceeds threshold value, the ECM judged this as a fault and DTC is set.

DTC DETECTING CONDITION EE2BACFE

Item	Detecting Condition	PossibleCause
DTC Strategy	• Rationality check	• Air Leakage • Short to battery in signal circuit • Faulty MAFS • Faulty EGR • Faulty ECM
Enable Conditions	• 2050 < Engine speed < 2600 rpm and injection quantity < 0 mg/st, barometric pressure > 750 hpa and -50°C < WTS < 120°C only	
Threshold Value	• Mass air flow > 950 mg/st	
Diagnostic Time	• 5 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• Yes • Yes • No • Yes	
Fail safe	• EGR valve deactivited • Fuel quantity limitation	

SPECIFICATION EAE10BF4

MAFS	Idle Position (without EGR)	Idle Position (with EGR)
Mass air flow	450~550 mg/stroke	280~360 mg/stroke

SCHEMATIC DIAGRAM EEDDFF90

Refer to DTC P0100.

SIGNAL WAVEFORM E1FF27A9

Refer to DTC P0100.

MONITOR SCANTOOL DATA E6097C04

Refer to DTC P0100.

SYSTEM INSPECTION E207411D

1. Check Air Leakage.
   1) Check intake and MAFS for source of any air leaks.
      Check any cracks or deformation on MAFS and check that MAFS is installed in correct position.
   2) Verify oil cap and dipstick are properly installed and oil cap screwed on completely.
   3) Has a problem been found?

      YES

      ▶ Repair or Replace as necessary and go to "Verification of Vehicle Repair" procedure .

      NO

      ▶ Go to "APS Inspection" procedure.
2. Check APS.
   1) Ignition OFF.
   2) Connect Scantool and monitor Accel Position Sensor parameters on Current Data.

      Specification : Approx. 0.4 ~ 0.7V(at Idle), 4.4 ~ 4.8V(Wide Open Throttle)

   3) Is parameter displayed within specifications?

      YES

      ▶ Go to "Check EGR solenoid valve operation" as below.

      NO

      ▶ Go to "APS Inspection" procedure. For more detail inspection, refer to DTC P0120,P0123,P0220,P0223 and P2123 for APS troubleshooting guide.
3. Check EGR solenoid valve operation.
   1) Ignition "ON" & Engine "ON".
   2) Confirm that EGR solenoid valve Duty is 5% after warming-up Engine.
   3) Be sure that vacuum is felt after disconnecting vaccum hose from EGR solenoid valve.
   4) Check that vacuum is felt in idle after sudden accelleration(EGR solenoid valve Duty : 95%).

EGR DUTY : 5%	EGR DUTY : 95%
No Vaccum	Vacuum

   5) Is the vaccum felt from vaccum hose according to EGR DUTY?

      YES

      ▶ Go to "W/Harness Inspection" procedure.

      NO

      ▶ Check EGR solenoid for contamination, deterioration, or damage. Substitute with a known-good EGR and check for proper operation. If the problem is corrected, replace EGR and then go to "Verification of Vehicle Repair" procedure.

TERMINAL & CONNECTOR INSPECTION EDC369B8

1. Many malfunctions in the electrical system are caused by poor harness and terminals.

   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

   YES

   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

   NO

   Go to "Component Inspection " procedure.

COMPONENT INSPECTION EC046EB0

1. Visual Inspection
   1) Ignition "OFF" & Engine "OFF".
   2) Check that arrow mark on the MAFS is indicating correct direction.
   3) Check any contamination, corriosion or damage on connector.
   4) Check that air cleaner is clogged or wet.
   5) Check that MAFS cylinder is deformed, blocked by any foreign material or contaminated.

   NOTE

   Hot film can be seriously damaged by foreign material or moisture.

   6) Is the MAFS visually O.K ?

   YES

   ▶ Go to "Check MAFS" as below.

   NO

   ▶ Substitute with a known-good MAFS and check for proper operation.
   If the problem is corrected, replace MAFS and then go to "Verification of Vehicle Repair" procedure.

2. Check MAF.
   1) Engine "ON".
   2) Warm up the engine to normal operating temperature.
   3) Check any leakage on intake system(Leakage or damage on intercooler hose).
   4) Check that EGR operates after sudden accelleration elasped around 90 sec.
      If necessary, disconnect EGR vaccum hose.
   5) Monitor "MASS AIR FLOW" parameter on the CURRENT DATA.

Specification : 500mg/st ± 50mg/st

1.2 CURRENT DATA

*	MASS AIR FLOW	495	mg/st
*	EGR ACTUATOR	95.0	%
	ENGINE SPEED	764	rpm
	VEHICLE SPEED SENSOR	0	Km/h
	FUEL PRESSURE	275.0	bar
	FUEL PRESS. REGULATOR	16.0	%
	BAROMETRIC PRESS.SNSR	101	kPa
	CLUTCH SW.(M/T ONLY)	ON	

FIX SCRN FULL PART GRPH HELP

E0100-8

   6) Is the current data displayed correctly ?

YES

▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification vehicle Repair" procedure.

NO

▶ Substitute with a known-good MAFS and check for proper operation.
If the problem is corrected, replace MAFS and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EFB5BC3D

Refer to DTC P0100.

DTC P0102 | MASS OR VOLUME AIR FLOW CIRCUIT LOW VOLTAGE

COMPONENT LOCATION EAEDABC2

Refer to DTC P0100.

DESCRIPTION E7590F4F

GENERAL DESCRIPTION

Refer to DTC P0100.

DTC DESCRIPTION

If the signal is below threshold value, the ECM judged this as a fault and DTC is set.

DTC DETECTING CONDITION EBFBCE5E

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal check, low	• open in power circuit • short to ground in signal circuit • open in ground circuit • Faulty MAFS • Faulty ECM
Enable Conditions	• Engine run	
Threshold Value	• Output signal < - 25 kg/h	
Diagnostic Time	• 1 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• Yes • Yes • No • Yes	
Fail safe	• EGR valve deactivited • Fuel quantity limitation	

SPECIFICATION EE9C8CDB

MAFS	Idle Position (without EGR)	Idle Position (with EGR)
Mass air flow	450~550 mg/stroke	280~360 mg/stroke

SCHEMATIC DIAGRAM E39051E3

Refer to DTC P0100.

SIGNAL WAVEFORM E6CE7FE6

Refer to DTC P0100.

MONITOR SCANTOOL DATA E0D0A7E5

Refer to DTC P0100.

TERMINAL & CONNECTOR INSPECTION ED71DC89

1. Many malfunctions in the electrical system are caused by poor harness and terminals.

   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

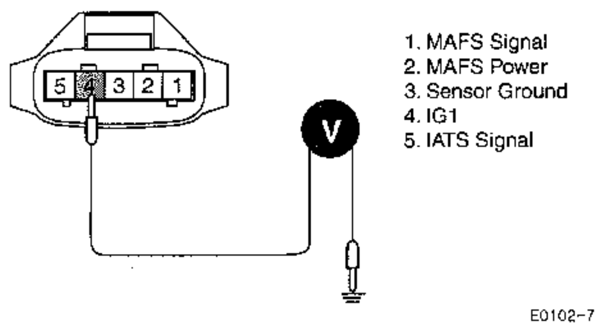
Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION ETEFB29A

1. Check for short in harness.
   1) Ignition "OFF".
   2) Disconnect MAF sensor connector.
   3) Ignition "ON" & Engine "OFF".
   4) Measure voltage between terminal "4" of the sensor harness connector and chassis ground.

Specification : Approx. B+

[C-231]



   5) Is the measured voltage within specifications ?

YES

▶ Go to " Signal Circuit Inspection" procedure.

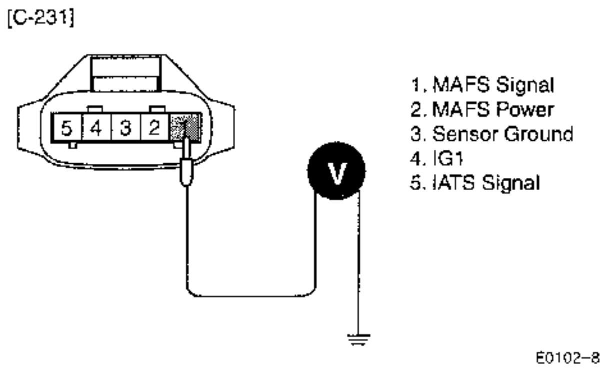
NO

▶ Check for open in polwer (IG1) harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION EE4219F6

1. Ignition "OFF".
2. Disconnect MAF sensor connector and ECM connector.
3. Ignition "ON" & Engine "OFF"
4. Measure voltage between terminal "1" of the MAF sensor harness connector and chassis ground.

Specification : Approx. 5V



5. Is the measured voltage within specifications ?

YES

▶ Go to "Ground Circuit Inspection" procedure.

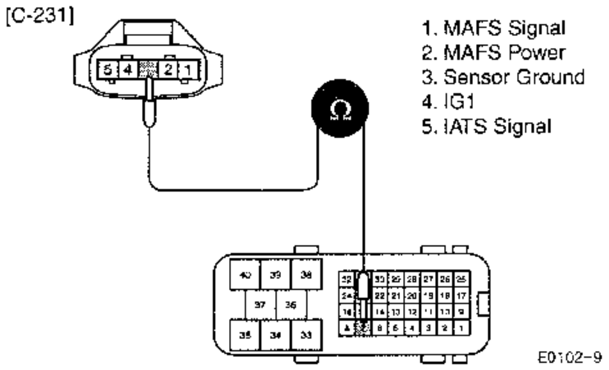
NO

▶ Check for short to ground in signal harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION E276CE05

1. Ignition "OFF".
2. Disconnect MAF sensor connector and ECM connector.
3. Measure resistance between terminal "3" of the sensor harness connector and terminal "7" of ECM harness connector.

Specification : Approx. below 1Ω



4. Is the measured resistance within specifications ?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Check for open in ground harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E7F69CA0

Refer to DTC P0100.

VERIFICATION OF VEHICLE REPAIR EC8CD1BA

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle within DTC Enable conditions in General information.
3. Are any DTCs present ?

YES

Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

DTC P0103 | MASS OR VOLUME AIR FLOW CIRCUIT HIGH VOLTAGE

COMPONENT LOCATION E6BAEF2C

Refer to DTC P0100.

DESCRIPTION EADC1E2B

GENERAL DESCRIPTION

Refer to DTC P0100.

DTC DESCRIPTION

If the signal is above threshold value, the ECM judged this as a fault and DTC is set.

DTC DETECTION CONDITION ED6CDC3E

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal check, high	• Short to battery in signal circuit • Open in signal circuit • Faulty MAFS • Faulty ECM
Enable Conditions	• Engine run	
Threshold Value	• Output signal > 700 kg/h	
Diagnostic Time	• 0.1 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• Yes • Yes • No • Yes	
Fail safe	• EGR valve deactivited • Fuel quantity limitation	

SPECIFICATION EB62C248

MAFS	Idle Position (without EGR)	Idle Position (with EGR)
Mass air flow	450~550 mg/stroke	280~360 mg/stroke

SCHEMATIC DIAGRAM EFCDB9DC

Refer to DTC P0100.

SIGNAL WAVEFORM E26FDEDC

Refer to DTC P0100.

MONITOR SCANTOOL DATA E7EAA468

Refer to DTC P0100.

TERMINAL & CONNECTOR INSPECTION E9CA02DD

1. Many malfunctions in the electrical system are caused by poor harness and terminals.
   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

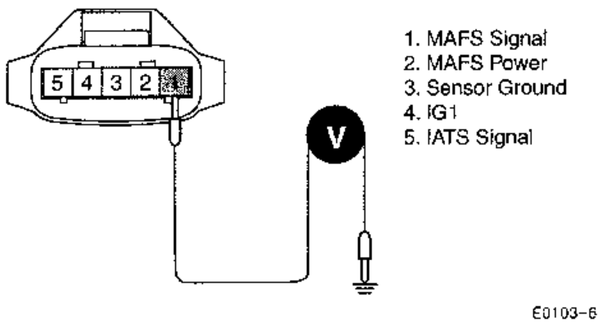
Go to " Power Circuit Inspection " procedure.

SIGNAL CIRCUIT INSPECTION EE24F971

1. Check for short to battery in harness
   1) Ignition "OFF".
   2) Disconnect MAF sensor connector.
   3) Ignition "ON" & Engine "OFF" .
   4) Measure voltage between terminal 1 of the sensor harness connector and chassis ground.

Specification : Approx. 5V

<C-231>



   5) Is the measured voltage within specifications?

YES

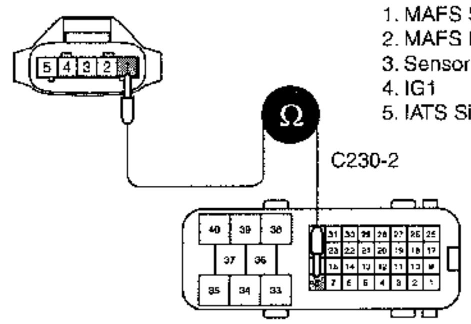
▶ Go to "Check open in signal harness" as below.

NO

▶ Check for short to battery in signal harness.
Repair as necessary and go to "Verification vehicle Repair" procedure.

2. Check for open in harness
   1) Ignition "OFF".
   2) Disconnect MAF sensor and ECM connector.
   3) Measure resistance between terminal 1 of the sensor harness connector and terminal 8 of the ECM harness connector.

Specification : Approx. below 1Ω



   4) Is the measured resistance within specifications?

YES

▶ Go to 'Component Inspection" procedure

NO

▶ Check for open in signal harness.
Repair as necessary and go to "Verification vehicle Repair" procedure.

COMPONENT INSPECTION E4BF39DE

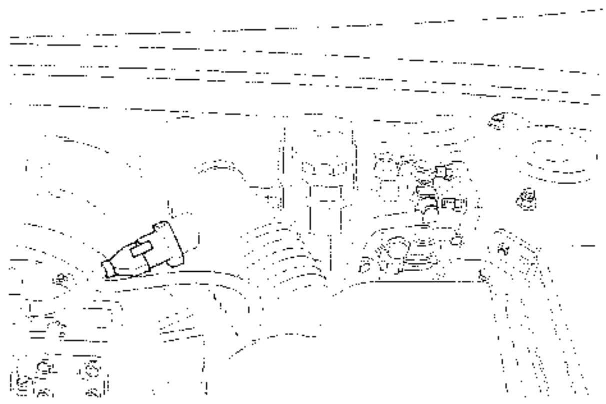
Refer to DTC P0100.

VERIFICATION OF VEHICLE REPAIR E939FE6B

Refer to DTC P0100.

DTC P0112 | INTAKE AIR TEMPERATURE LOW INPUT

COMPONENT LOCATION ED25D473



E0112-1

DESCRIPTION EFE3E2E6

GENERAL DESCRIPTION

IATS (Intake Air Temperature Sensor) is intergrated in MAF sensor.

This part employs a thermistor (NTC) which is sensitive to changes in temperature.

The electric resistance of a thermistor decreases as the temperature increases, and increases as the temperature decreases.

The power source in the ECM is supplied to the IATS via a resistor in the ECM.

The ECM judges intake air temperature by the sensor output voltage and is used for injection quantity correction, injection time correction, starting fuel quantity correction as a compensation signal.

DTC DESCRIPTION

If the signal below threshold value, the ECM judged this as a fault and DTC is set.

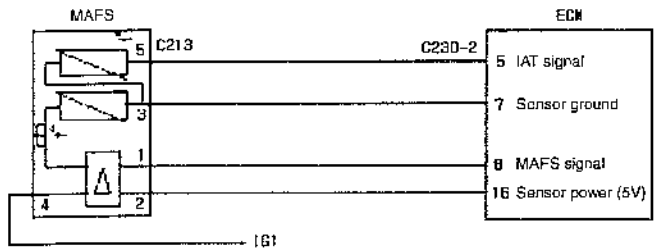
DTC DETECTING CONDITION EE8CEFFF

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal check, low	• Short to ground in signal circuit • Faulty IATS • Faulty ECM
Enable Conditions	• Ignition on	
Threshold Value	• Output signal < 112 mV	
Diagnostic Time	• 2 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• No • No • No • Yes	
Fail safe	• Engine air temperature is fixed at value of 60°C by ECM	

SPECIFICATION EBC4BE93

IATS			
Temperature (°C)	20	40	60
Resistance (kΩ)	2.29 ~ 2.55	1.1 ~ 1.2	0.56 ~ 0.65

SCHEMATIC DIAGRAM ECAC2CFA



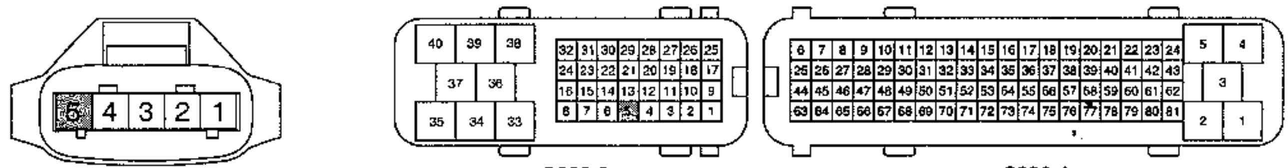
[Connection Information]

1	C230-2 Terminal 8	MAFS signal
2	C230-2 Terminal 16	Sensor power
3	C230-2 Terminal 7	Sensor ground
4	IG1	IG1 Power
5	C230-2 Terminal 5	IAT Signal

[CONNECTOR]

MAFS Harness side connector

ECM side terminal

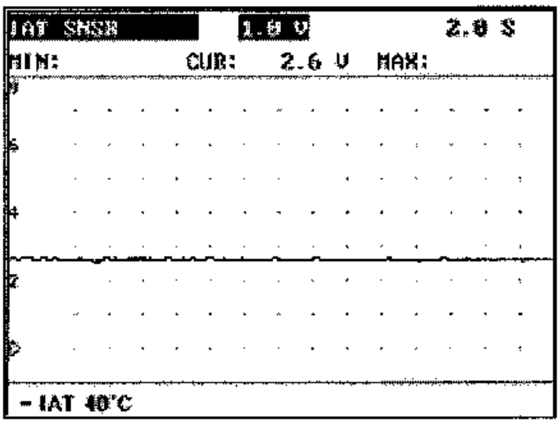


MAFS (C213)

C230-2

C230-1

SIGNAL WAVEFORM E1S8AB0S



IATS and ECTS signals should be smooth and continuous without any sudden changes.
When the engine is cold, IATS and ECTS signals should look similar, depending on the ambient air temperature.
After warmed-up the IATS signal should not have changed less significantly while ECTS signal should have some dropped.
This indicates the normal increase of the engine coolant temperature is larger than the normal increase of the intake air temperature as the engine warms up.

MONITOR SCANTOOL DATA ED124F15

1. Ignition "OFF" & Engine "OFF".
2. Install Scantool and Engine "ON".
3. Monitor Intake Air Temperature Sensor on Current data.

FIG 1

1.2 CURRENT DATA		
* INT.AIR TEMP.SNSR	18.1	°C
BATTERY VOLTAGE	14.3	V
MASS AIR FLOW	492	mg/st
ACCEL.POSITION SENSOR	0.0	%
ACCEL.POSITION SENSOR	713.6mV	
COOLANT TEMP. SENSOR	66.4	°C
ENGINE SPEED	756	rpm
VEHICLE SPEED SENSOR	0	Km/h

FIX | SCRN | FULL | PART | GRPH | HELP

Fig 1) Signal decreases with increasing sensor temperature and increases with decreasing sensor temperature : Approx. 2V at 20°C(68°F)

Is the Current data displayed correctly ?

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "W/Harness Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION EA2B9EAA

1. Many malfunctions in the electrical system are caused by poor harness and terminals.

   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

   YES

   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

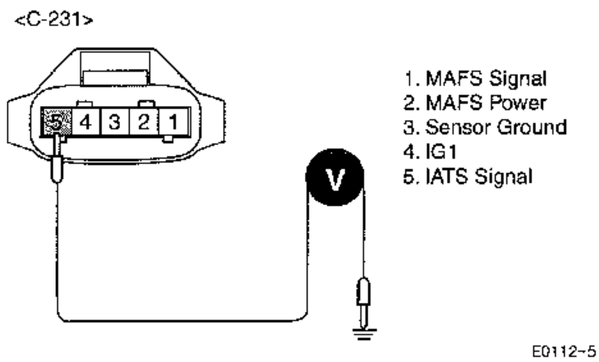
   NO

   Go to "Power Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION E62F64BA

1. Check for short to battery in harness
   1) Ignition "OFF".
   2) Disconnect IAT sensor connector.
   3) Measure voltage between terminal 5 of the sensor harness connector and chassis ground.

Specification : Approx. 5V



   4) Is the measured voltage within specifications?

YES

▶ Go to "Component Inspection" procedure.

NO

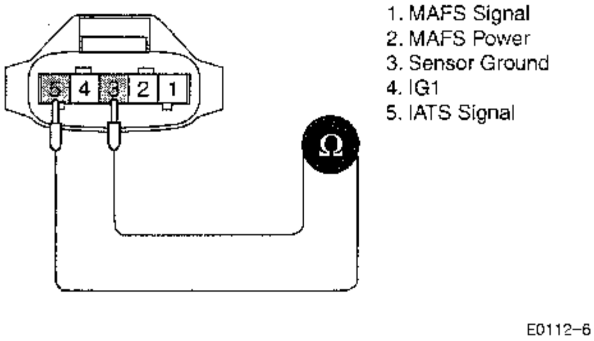
▶ Check for short to battery in signal harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E9ED7BBC

1. Check IATS
   1) Ignition "OFF" & Engine "OFF".
   2) Disconnect IATS connector.
   3) Monitor resistance between terminal 3 and 5 of IATS connector(Component Side).

SPECIFICATION :

Temperature (°C)	20	40	60
Resistance (KΩ)	2.29 ~ 2.55	1.1 ~ 1.2	0.56 ~ 0.65



4) Is the measured resistance within specifications?

YES

▶ Substitute with a known-good ECM and check for proper operation.
If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Substitute with a known-good IATS and check for proper operation.
If the problem is corrected, replace IATS and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E3FAA0BB

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle within DTC Enable conditions in General information.
3. Are any DTCs present ?

YES

Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

DTC P0113 | INTAKE AIR TEMPERATURE HIGH INPUT

COMPONENT LOCATION E8006E3E

Refer to DTC P0112.

DESCRIPTION E4073448

GENERAL DESCRIPTION

Refer to DTC P0112.

DTC DESCRIPTION

If the signal is above threshold value, the ECM judged this as a fault and DTC is set.

DTC DETECTING CONDITION EB7B12DC

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal check, high	• Short to ground in signal circuit • Open in signal circuit • Open in ground circuit • Faulty IATS • Faulty ECM
Enable Conditions	• Ignition on	
Threshold Value	• Output signal > 4.9V	
Diagnostic Time	• 2 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• No • No • No • Yes	
Fail safe	• Engine air temperature is fixed at value of 60°C by ECM	

SPECIFICATION ED055F6C

IATS			
Temperature (°C)	20	40	60
Resistance (kΩ)	2.29 ~ 2.55	1.1 ~ 1.2	0.56 ~ 0.65

SCHEMATIC DIAGRAM EAB56EE8

Refer to DTC P0112.

SIGNAL WAVEFORM EEAB7CEF

Refer to DTC P0112.

MONITOR SCANTOOL DATA E0598B72

Refer to DTC P0112.

TERMINAL & CONNECTOR INSPECTION ECFCBF80

1. Many malfunctions in the electrical system are caused by poor harness and terminals.
   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

   YES

   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

   NO

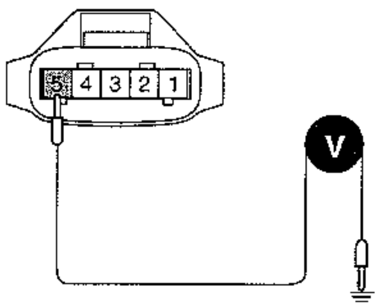
   Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION EF9CEE9D

1. Check for short to battery in signal harness
   1) Ignition "OFF".
   2) Disconnect IAT sensor connector.
   3) Measure voltage between terminal 5 of the sensor harness connector and chassis ground.

   Specification : Approx. 5V

<C-231>



1. MAFS Signal
2. MAFS Power
3. Sensor Ground
4. IG1
5. IATS Signal

E0113-5

   4) Is the measured voltage within specifications?

   YES

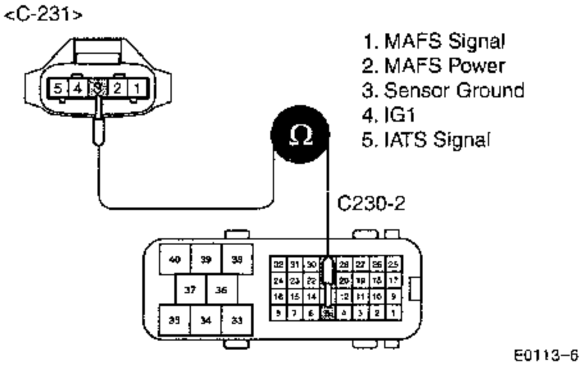
   ▶ Go to "Check for open in signal harness" as below.

   NO

   ▶ Check for short to battery in signal harness.
   Repair as necessary and go to "Verification vehicle Repair" procedure.

2. Check for open in signal harness
   1) Ignition "OFF"
   2) Disconnect IAT sensor connector and ECM connector.
   3) Measure resistance between terminal 5 of the sensor harness connector and terminal 5 of ECM harness connector.

Specification : Approx. below 1Ω



   4) Is the measured resistance within specifications?

YES

▶ Go to "Signal Circuit Inspection" procedure.

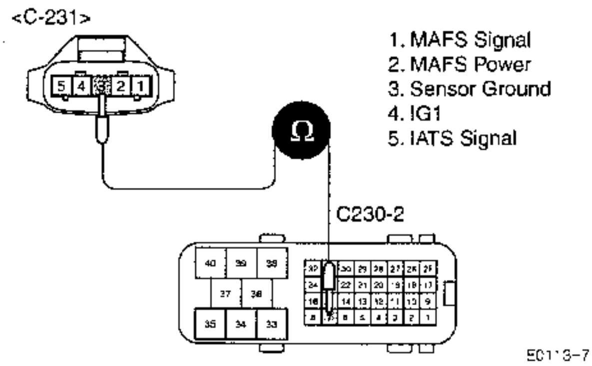
NO

▶ Check for open in harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION E591C49D

1. Ignition "OFF".
2. Disconnect IAT sensor connector and ECM connector.
3. Measure resistance between terminal 3 of the sensor harness connector and terminal 7 of ECM harness connector.

Specification : Approx. below 1Ω



4. Is the measured resistance within specifications?

YES

▶ Go to "Component Inspection" procedure.

NO

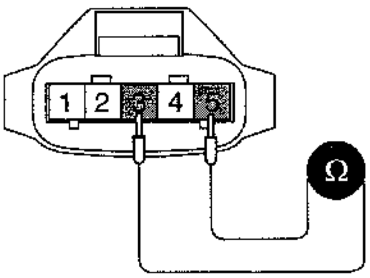
Check for open in ground harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure .

COMPONENT INSPECTION EBED21AB

1. Check IATS
   1) Ignition "OFF" & Engine "OFF".
   2) Disconnect IATS connector.
   3) Monitor resistance between terminal 3 and 5 of IATS connector(Component Side).

SPECIFICATION :

Temperature (°C)	20	40	60
Resistance (KΩ)	2.29 ~ 2.55	1.1 ~ 1.2	0.56 ~ 0.65



1. MAFS Signal
2. MAFS Power
3. Sensor Ground
4. IG1
5. IATS Signal

E0113-8

4) Is the measured resistance within specifications?

YES

▶ Substitute with a known-good ECM and check for proper operation.
If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.

NO

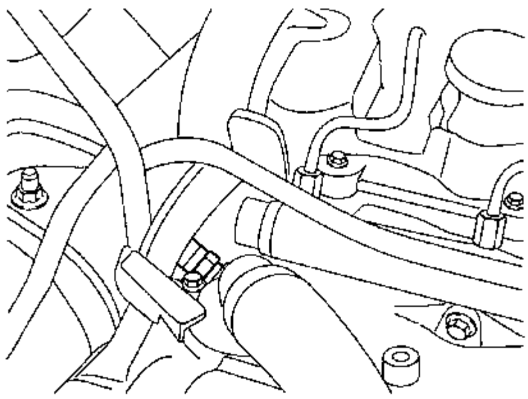
▶ Substitute with a known-good IATS and check for proper operation.
If the problem is corrected, replace IATS and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E6FFD9AA

Refer to DTC P0112.

DTC P0116 | ENGINE COOLANT TEMPERATURE CIRCUIT RANGE/PERFRMANCE

COMPONENT LOCATION E1AF171D



E0116-1

DESCRIPTION E7A6EC26

GENERAL DESCRIPTION

ECTS (Engine Coolant Temperature Sensor) located in the engine coolant passage of the cylinder head.

It detects the water temperature and relays signals to the ECM.

It employs a thermistor, which is sensitive to the changes in the coolant temperature.

The electric resistance of a thermistor decreases as the fuel temperature increases, and increases as the fuel temperature decreases.

The power source in the ECM is supplied to the ECTS via a resistor in the ECM.

The electric resistance of a thermistor decreases in response to the temperature rise.

The ECM judges engine coolant temperature by sensor output voltage and provides optimum fuel enrichment when the engine is cold and in order to operate the radiator fan and the A/C condensor fan.

DTC DESCRIPTION

If the signal exceeds threshold value, the ECM judged this as a fault and DTC is set.

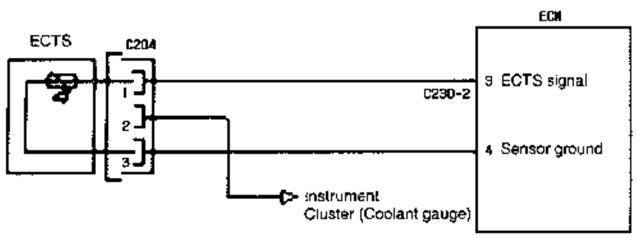
DTC DETECTING CONDITION EA43F22E

Item	Detecting Condition	Possible Cause
DTC Strategy	• Rationality check	• Open in signal circuit • Open in ground circuit • Short in signal circuit • Faulty Thermostat • Faulty IATS • Faulty ECM
Enable Conditions	• Ignition on	
Threshold Value	• Error is reconized when the rising time of coolant temperature up to 40°C(113°F) is deviated from below data after the engine starting -40°C(-40°F) @65535 sec. -20°C(-4°F) @750 sec. 5.5°C @572 sec. 40°C(113°F) @20 sec.	
Diagnostic Time	• 0 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• No • No • No • No	
Fail safe	• Engine temp. is fixed at value of 80°C after cranking and -25°C when cranking by ECM. • Engine performance is reduced over 120°C • Radiator cooling fan and A/C condensor fan are operated. • Air conditioning system deactivated • Water heater deactivated	

SPECIFICATION E476BF3F

	ECTS	
Temperature (°C)	20	80
Resistance (kΩ)	2.31 ~ 2.59	0.31 ~ 0.33

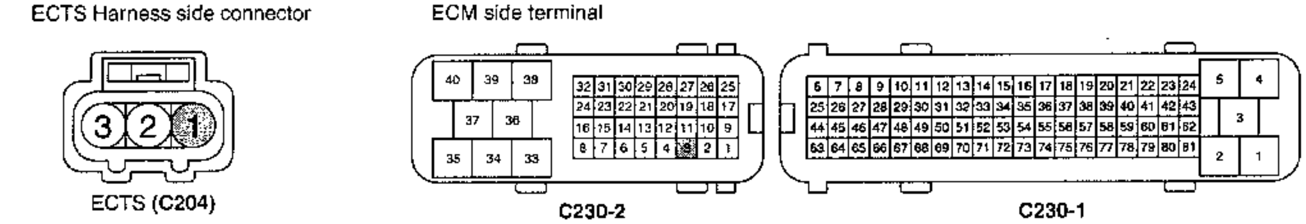
SCHEMATIC DIAGRAM E9F7EEC3



[Connection Information]

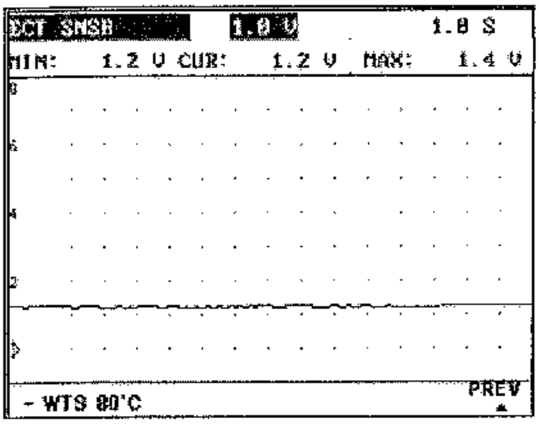
1	C230-2 Terminal 3	Sensor signal
2	Instrument cluster	Sensor power
3	C230-2 Terminal 4	Sensor ground

[CONNECTOR]



E0116-2

SIGNAL WAVEFORM ED8CCCCC



IATS and ECTS signals should be smooth and continuous without any sudden changes.
When the engine is cold, IATS and ECTS signals should look similar, depending on the ambient air temperature.
After warmed-up the IATS signal should not have changed less significantly while ECTS signal should have some dropped.
This indicates the normal increase of the engine coolant temperature is larger than the normal increase of the intake air temperature as the engine warms up.

FQ116-3

MONITOR SCANTOOL DATA E8BADB57

1. Ignition "OFF" & Engine "OFF".
2. Install Scantool and Engine "ON".
3. Monitor Engine Coolant Temperature Sensor on Current data.

FIG 1

	1.2 CURRENT DATA		
*	INT.AIR TEMP.SNSR	16.0	°C
*	COOLANT TEMP. SENSOR	51.2	°C
	BATTERY VOLTAGE	14.4	V
	MASS AIR FLOW	487	mg/st
	ACCEL.POSITION SENSOR	0.0	%
	ACCEL.POSITION SENSOR	738.0mV	
	ENGINE SPEED	815	rpm
	VEHICLE SPEED SENSOR	0	Km/h

FIX | SCRN | FULL | PART | GRPH | HELP

Fig 1) Signal decreases with increasing sensor temperature and increases with decreasing sensor temperature

Is Current data displayed correctly ?

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "W/Harness Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION EEF2E9D9

1. Many malfunctions in the electrical system are caused by poor harness and terminals.
   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

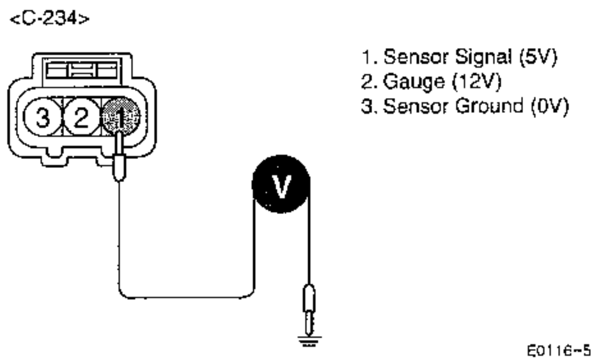
NO

Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION EB02B664

1. Ignition "OFF".
2. Disconnect ECT sensor connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 1 of the sensor harness connector and chassis ground.

Specification : Approx. 5V



5. Is the measured voltage within specifications?

YES

▶ Go to "Ground Circuit Inspection" procedure.

NO

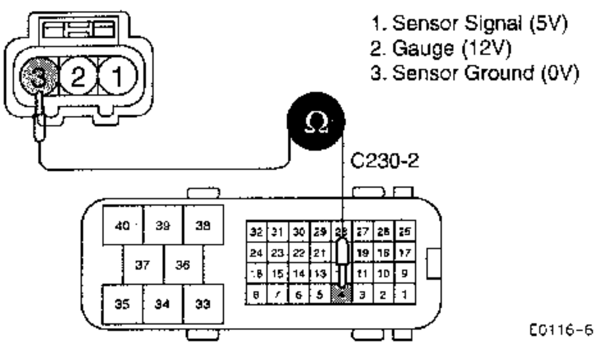
▶ Check for open or short in the signal harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION EC62147A

1. Ignition "OFF".
2. Disconnect ECT sensor connector and ECM connector.

3. Measure resistance between terminal 3 of the sensor harness connector and terminal 4 of ECM harness connector.

Specification : Approx. below 1Ω



4. Is the measured resistance within specifications?

YES

▶ Go to "Component Inspection" procedure.

NO

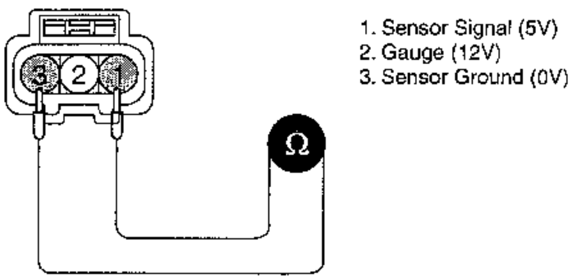
Check for open in ground harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure .

COMPONENT INSPECTION E1CEA2EE

1. Check MAF
   1) Ignition "OFF"
   2) Disconnect ECTS connector.
   3) Monitor resistance between terminal 1 and 3 of ECTS connector(Component Side).

SPECIFICATION :

Temperature (°C)	-20	0	20	40	80
Resistance (KΩ)	15.48 ± 1.35	5.79	2.45 ± 0.1	1.148	0.3222



4) Is the measured resistance within specifications?

YES

▶ Go to "Check thermostat " as below.

NO

▶ Substitute with a known-good ECTS and check for proper operation.
If the problem is corrected, replace ECTS and then go to "Verification of Vehicle Repair" procedure.

2. Check Thermostat

1) Engine "ON"

NOTE

This test should be performed under cold temperature.

2) Remove radiator cap.

3) Warm up the engine to normal operating temperature.

4) Check that engine coolant circulates.

5) Does engine coolant circulate ?

YES

▶ Substitute with a known-good ECM and check for proper operation.
If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Substitute with a known-good Thermostat and check for proper operation.
If the problem is corrected, replace thermostat and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E56A39FE

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle within DTC Enable conditions in General information.
3. Are any DTCs present ?

YES

Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

DTC P0117 | ENGINE COOLANT TEMPERATURE CIRCUIT LOW INPUT

COMPONENT LOCATION E0EAF7FA

Refer to DTC P0116.

DESCRIPTION E6E75CF2

GENERAL DESCRIPTION

Refer to DTC P0116.

DTC DESCRIPTION

If the signal exceeds threshold value, the ECM judged this as a fault and DTC is set.

DTC DETECTING CONDITION EF24720D

<table>
<tr><th>Item</th><th>Detecting Condition</th><th>Possible Cause</th></tr>
<tr><td>DTC Strategy</td><td>• Signal check, low</td><td rowspan="6">• Short to ground in signal circuit
• Faulty ECTS
• Faulty ECM</td></tr>
<tr><td>Enable Conditions</td><td>• Ignition on</td></tr>
<tr><td>Threshold Value</td><td>• Output signal < 225 mV</td></tr>
<tr><td>Diagnostic Time</td><td>• 0.5 sec.</td></tr>
<tr><td>MIL
Fuel Limit
Fuel Cut
EGR Off</td><td>• No
• No
• No
• Yes</td></tr>
<tr><td>Fail safe</td><td>• Engine temp. is fixed value of 80°C after cranking and -25°C when cranking by ECM.
• Engine performance is reduced over 120°C
• Radiator cooling fan and A/C condensor fan is operated.
• Air conditioning system deactivation
• Water heater deactivation</td></tr>
</table>

SPECIFICATION EEED791E

ECTS		
Temperature (°C)	20	80
Resistance (kΩ)	2.31 ~ 2.59	0.31 ~ 0.33

SCHEMATIC DIAGRAM EB9DBEB2

Refer to DTC P0116.

SIGNAL WAVEFORM EC5D2C2F

Refer to DTC P0116.

MONITOR SCANTOOL DATA E1B0A2B5

Refer to DTC P0116.

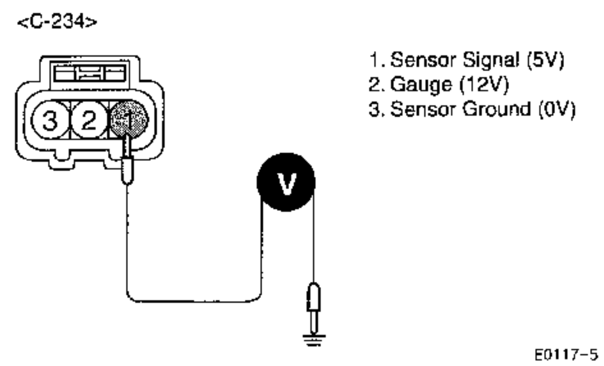
TERMINAL & CONNECTOR INSPECTION EDD349C4

Refer to DTC P0116.

SIGNAL CIRCUIT INSPECTION EA749749

1. Ignition "OFF".
2. Disconnect ECT sensor connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 1 of the sensor harness connector and chassis ground.

Specification : Approx. 5V



5. Is the measured voltage within specifications?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Check for short to ground in signal harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E6EA6C4F

Refer to DTC P0116.

VERIFICATION OF VEHICLE REPAIR E91E82DB

Refer to DTC P0116.

DTC P0118 | ENGINE COOLANT TEMPERATURE CIRCUIT HIGH INPUT

COMPONENT LOCATION EE122B38

Refer to DTC P0116.

DESCRIPTION EB2B7A43

GENERAL DESCRIPTION

Refer to DTC P0116.

DTC DESCRIPTION

If the signal exceeds threshold value, the ECM judged this as a fault and DTC is set.

DTC DETECTING CONDITION E82A475C

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal check, high	• Short to battery in signal circuit • Open in signal circuit • Open in ground circuit • Faulty ECTS • Faulty ECM
Enable Conditions	• Ignition on	
Threshold Value	• Output signal > 4.97 V	
Diagnostic Time	• 0.5 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• No • No • No • Yes	
Fail safe	• Engine temp. is fixed value of 80°C after cranking and -25°C when cranking by ECM. • Engine performance is reduced over 120°C • Radiator cooling fan and A/C condensor fan is operated. • Air conditioning system deactivation • Water heater deactivation	

SPECIFICATION EDF4B4D0

ECTS		
Temperature (°C)	20	80
Resistance (kΩ)	2.31 ~ 2.59	0.31 ~ 0.33

SCHEMATIC DIAGRAM E9B762E9

Refer to DTC P0116.

SIGNAL WAVEFORM E4CF1974

Refer to DTC P0116.

MONITOR SCANTOOL DATA EAB58E8C

Refer to DTC P0116.

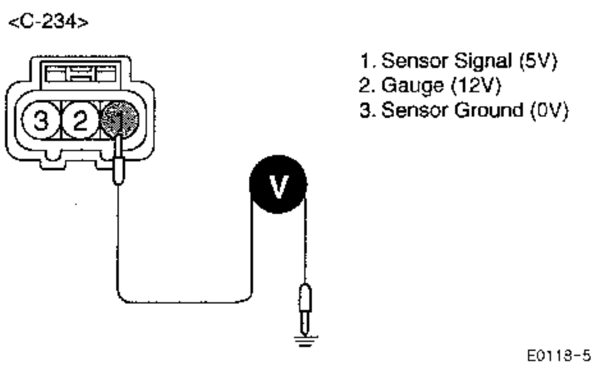
TERMINAL & CONNECTOR INSPECTION EC7B048E

Refer to DTC P0116.

SIGNAL CIRCUIT INSPECTION EE0DCB9E

1. Check for short to battery in signal harness
   1) Ignition "OFF"
   2) Disconnect ECT sensor connector.
   3) Ignition "ON" & Engine "OFF".
   4) Measure voltage between terminal 1 of the sensor harness connector and chassis ground

Specification : Approx. 5V



   5) Is the measured voltage within specifications ?

YES

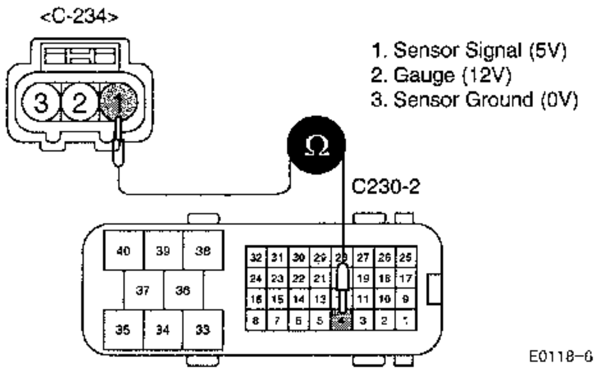
▶ Go to " Check for open in harness" as below.

NO

▶ Check for short to battery in signal harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for open in harness
    1) Ignition "OFF"
    2) Disconnect ECT sensor connector
    3) Ignition "ON" & Engine "OFF"
    4) Measure resistance between terminal 1 of the sensor harness connector and terminal 4 of ECM harness connector.

Specification : Approx. below 1Ω



    5) Is the measured resistance within specifications ?

YES

▶ Go to "Ground Circuit Inspection" procedure.

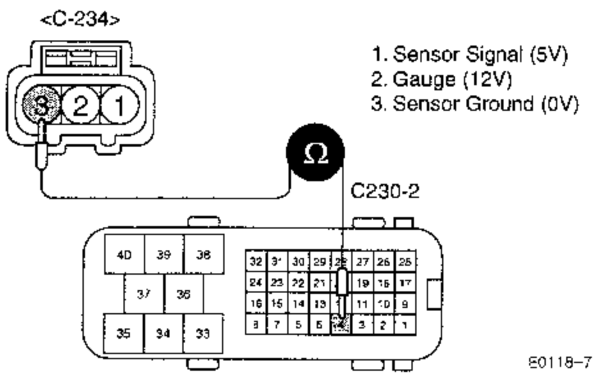
NO

▶ Check for open in signal harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION EBB680FA

1. Ignition "OFF"
2. Disconnect ECT sensor connector and ECM connector.
3. Measure resistance between terminal 3 of the sensor harness connector and terminal 4 of ECM harness connector.

Specification : Approx. below 1Ω



4. Is the measured resistance within specifications ?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Check for open in harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

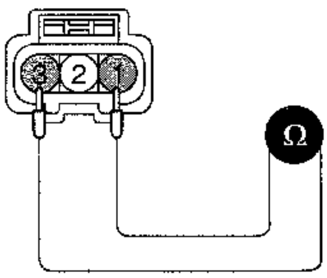
COMPONENT INSPECTION EFACDEA2

1. Check MAF
   1) Ignition "OFF"
   2) Disconnect ECTS connector.
   3) Monitor resistance between terminal 1 and 3 of ECTS connector(Component Side).

SPECIFICATION :

Temperature (°C)	-20	0	20	40	80
Resistance (KΩ)	15.48 ± 1.35	5.79	2.45 ± 0.1	1.148	0.3222

<C-234>



1. Sensor Signal (5V)
2. Gauge (12V)
3. Sensor Ground (0V)

E0118-8

   4) Is the measured resistance within specifications?

YES

▶ Go to "Check thermostat " as below.

NO

▶ Substitute with a known-good ECTS and check for proper operation.
If the problem is corrected, replace ECTS and then go to "Verification of Vehicle Repair" procedure.

2. Check Thermostat
   1) Engine "ON"

   NOTE

   This test should be performed under cold temperature.

   2) Remove radiator cap.
   3) Warm up the engine to normal operating temperature.
   4) Check that engine coolant circulates.
   5) Does engine coolant circulate ?

   YES

   ▶ Substitute with a known-good ECM and check for proper operation.
   If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.

   NO

   ▶ Substitute with a known-good Thermostat and check for proper operation.
   If the problem is corrected, replace thermostat and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E6F74C1F

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle within DTC Enable conditions in General information.
3. Are any DTCs present ?

YES

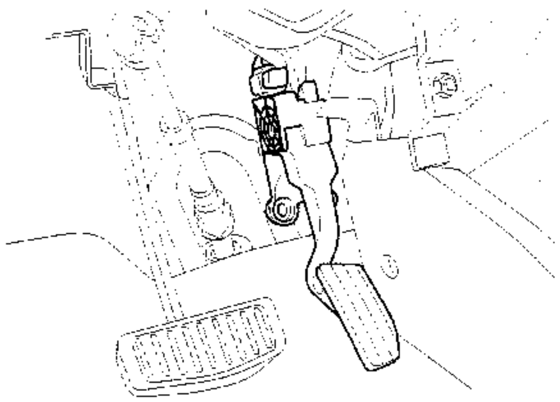
Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

DTC P0120 | THROTTLE POSITION CIRCUIT MALFUNCTION

COMPONENT LOCATION E0B1E2BE



E0120-1

DESCRIPTION E0212922

GENERAL DESCRIPTION

APS(Acceleration Position Sensor) is measured the driver's acceleration using a potentiometer and APS signal is transmitted to the ECM. The pedal's position is calculated from the voltage of potentiometer in the APS.

The absence of a mechanical link between the accelertor pedal and injection system presents a risk of loss of control of the engine in the event of a failure of the component in the charge of providing the driver's request information to the injection system.

Therefore, APS has the two potentiometers whose slides are mechanically solid.

APS 1 decides to the fuel quantity and injection timing in the engine.

DTC DESCRIPTION

If the signal exceeds threshold value, the ECM judged this as a fault and DTC is set.

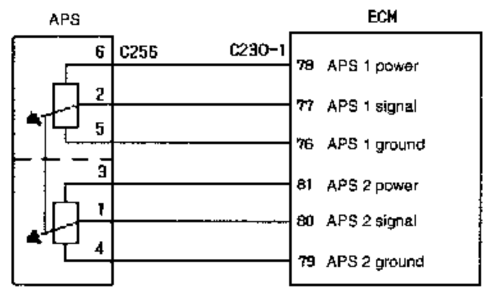
DTC DETECTING CONDITION EE91B72F

Item	Detecting Condition	Possible Cause
DTC Strategy	• Voltage range check	• Short in power circuit • Open in power circuit • Faulty APS • Faulty ECM
Enable Conditions	• Ignition on	
Threshold Value	• 4.7 V < Sensor supply voltage < 5.1 V	
Diagnostic Time	• 0.1 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• Yes • Yes • No • No	
Fail safe	• Engine speed is fixed at 1200 rpm without pedal sensor action. • Engine performance is reduced. • Air conditioning system is deactivited as against the vehicle speed and the engine rpm. • Cruise control system inhibited.	

SPECIFICATION ECED04C5

APS		
Accel pedal position	Idle Position (0%)	Fully Open Position (100%)
Signal votage	0.6 ~ 0.9 V	3.5 ~ 4.7 V

SCHEMATIC DIAGRAM E8FFC2C4

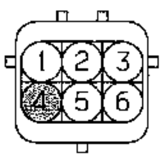


[Connection Information]

1	C230-1 Terminal 81	APS 2 power
2	C230-1 Terminal 77	APS 1 signal
3	C230-1 Terminal 80	APS 2 signal
4	C230-1 Terminal 78	APS 1 power
5	C230-1 Terminal 76	APS 1 ground
6	C230-1 Terminal 79	APS 2 ground

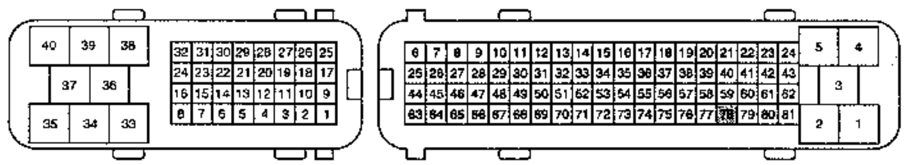
[CONNECTOR]

APS Harness side connector



APS (C256)

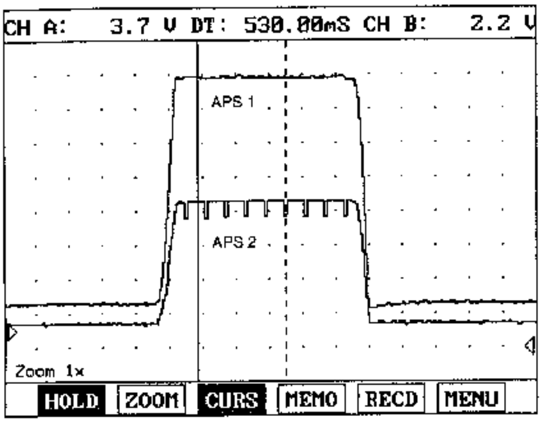
ECM side terminal



C230-2 C230-1

E0120-2

SIGNAL WAVEFORM E3AFF0C9



This test should be inspected after depressing the HOLD mode from run after the sudden acceleration.
As accel pedal is pressed down fully, the intensity of the APS 1 & 2 waveform increases individually.
APS 1 signal voltage is less than 1V to over 4V and APS 2 is 1/2 voltage as against APS 1 voltage.
The waveform pattern become increasing upward rapidly when the engine speed increases.

F0120-3

MONITOR SCANTOOL DATA E9A7DEDA

1. Ignition "OFF" & Engine "OFF".
2. Install Scantool and Engine "ON".
3. Monitor Acceleration Position Sensor on Current data.

FIG 1

	1.2 CURRENT DATA		
*	ACCEL.POSITION SENSOR	27.4	%
*	ACCEL.POSITION SENSOR	1603.	mV
	BATTERY VOLTAGE	14.2	V
	MASS AIR FLOW	354	mg/st
	INT.AIR TEMP.SNSR	20.2	°C
	COOLANT TEMP. SENSOR	52.0	°C
	ENGINE SPEED	2182	rpm
	VEHICLE SPEED SENSOR	0	Km/h

FIX | SCRN | FULL | PART | GRPH | HELP

Fig 1) Signal increases when depressing accel pedal : Approx. 600 ~900 Mv at idle speed.

Is Current data displayed correctly ?

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "W/Harness Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION EB43E55B

1. Many malfunctions in the electrical system are caused by poor harness and terminals.

   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

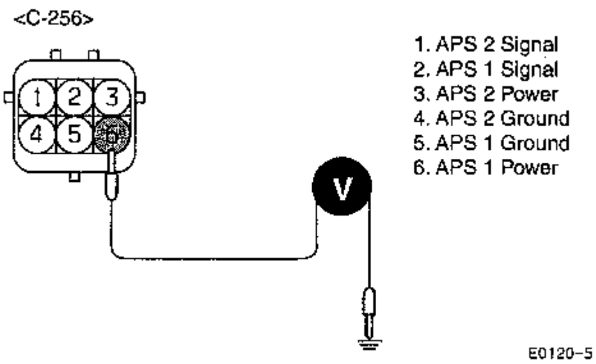
NO

Go to "Signal Circuit Inspection" procedure.

POWER CIRCUIT INSPECTION EA0CE265

1. Check for short in harness
   1) Ignition "OFF"
   2) Disconnect AP sensor connector.
   3) Ignition "ON" & Engine "OFF".
   4) Measure voltage between terminal 6 of the sensor harness connector and chassis ground.

Specification : 4.7V ~ 5.1V



   5) Is the measured voltage within specifications ?

YES

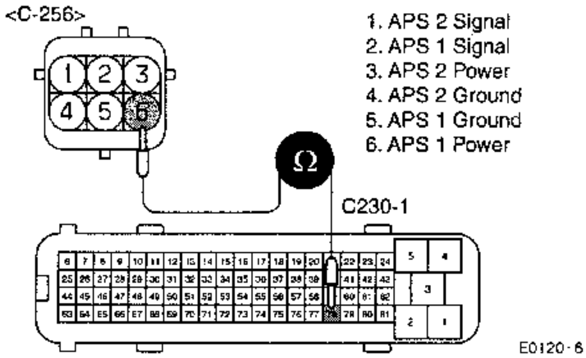
▶ Go to "Check for open in harness" as below.

NO

Check for short in the power harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for open in harness
   1) Ignition "OFF"
   2) Disconnect AP sensor connector and ECM connector
   3) Measure resistance between terminal 6 of the sensor harness connector and terminal 78 of ECM harness connector.

Specification : Approx. below 1Ω



   4) Is the measured voltage within specifications ?

YES

▶ Go to "Component Inspection" procedure.

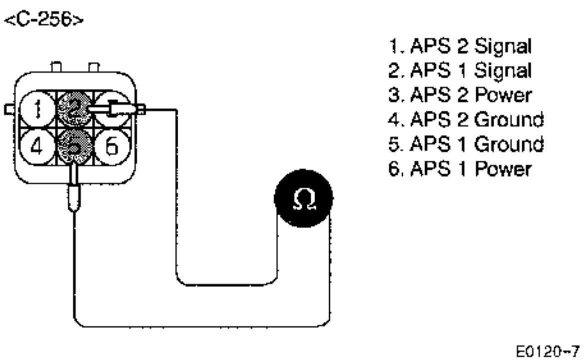
NO

▶ Check for open in the power harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION ED2D3FEA

1. Check APS
   1) Ignition "OFF"
   2) Disconnect APS connector.
   3) Check that resistance is getting lower by pressing APS to wide open.
   4) Measure resistance between terminal 2 and 5 of APS connector (Component side).

   Specification : 1.2kΩ ± 0.4kΩ (20°C)



   5) Is the measured resistance within specifications?

   YES

   ▶ Substitute with a known-good ECM and check for proper operation.
   If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.

   NO

   ▶ Substitute with a known-good APS and check for proper operation.
   If the problem is corrected, replace APS and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EE8D3E77

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle within DTC Enable conditions in General information.
3. Are any DTCs present ?

YES

Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

DTC P0123 | THROTTLE/PEDAL POSITION CIRCUIT HIGH INPUT

COMPONENT LOCATION E5D9BCFC

Refer to DTC P0120.

DESCRIPTION EFF252FB

GENERAL DESCRIPTION

Refer to DTC P0120.

DTC DESCRIPTION

If the signal is below threshold value, the ECM judged this as a fault and DTC is set.

DTC DETECTING CONDITION EC03A997

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal check, high	• Short to battery in signal circuit • Open in ground circuit • Faulty APS • Faulty ECM
Enable Conditions	• Ignition on	
Threshold Value	• Output signal > 4.91V	
Diagnostic Time	• 0.18 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• Yes • Yes • No • No	
Fail safe	• Engine speed is fixed at 1200 rpm without pedal sensor action. • Engine performance is reduced. • Air conditioning system is deactivited as against the vehicle speed and the engine rpm. • Cruise control system inhibited.	

SPECIFICATION E09AEE08

ECTS		
Temperature (°C)	20	80
Resistance (kΩ)	2.31 ~ 2.59	0.31 ~ 0.33

SIGNAL WAVEFORM E3CEF5A1

Refer to DTC P0120.

MONITOR SCANTOOL DATA E76A1210

Refer to DTC P0120.

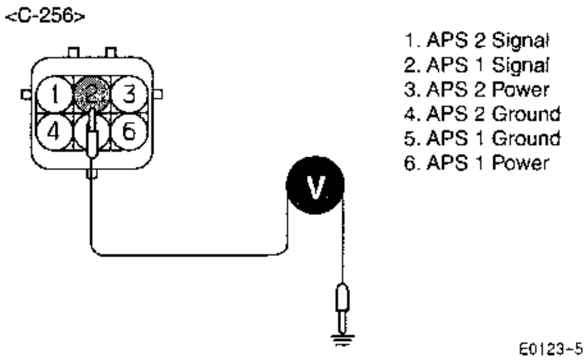
TERMINAL & CONNECTOR INSPECTION E2EA70B4

Refer to DTC P0120.

SIGNAL CIRCUIT INSPECTION E8E84EBD

1. Check for short to battery in signal harness
   1) Ignition "OFF"
   2) Disconnect AP sensor connector.
   3) Measure voltage between terminal 2 of the sensor harness connector and chassis ground.

   Specification : Approx. below 1V



   4) Is the measured resistance within specifications ?

   YES

   ▶ Go to " Power Circuit Inspection" procedure.

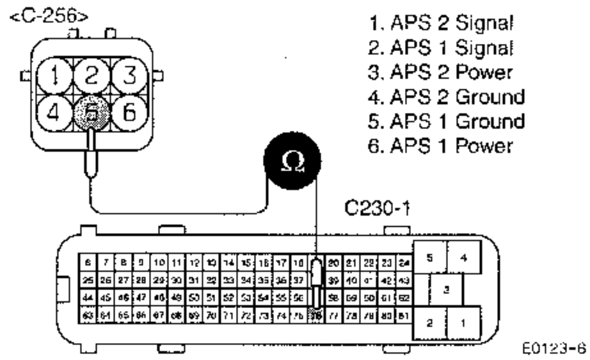
   NO

   ▶ Check for short to battery in harness.
   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION E05BBC31

1. Ignition "OFF"
2. Disconnect AP sensor connector.
3. Measure resistance between terminal 5 of the sensor harness connector and terminal 76 of ECM connector.

Specification : Approx. below 1Ω



4. Is the measured resistance within specifications ?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Check for open in the ground harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EFED6240

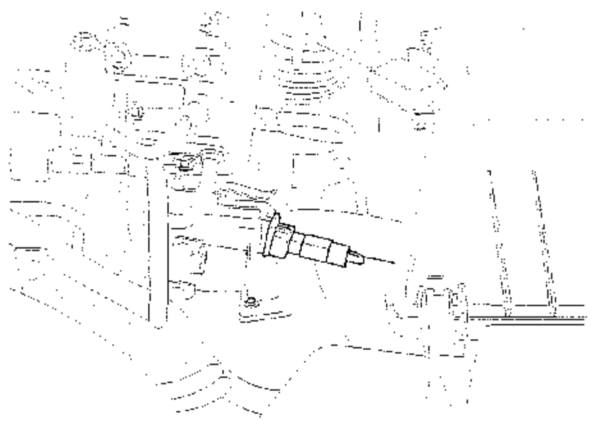
Refer to DTC P0120.

VERIFICATION OF VEHICLE REPAIR E49D1F4D

Refer to DTC P0120.

DTC P0182 | FUEL TEMP. SENSOR A CIRCUIT LOW INPUT

COMPONENT LOCATION EA838755



E0182-1

DESCRIPTION E3B69DDF

GENERAL DESCRIPTION

FTS(Fuel Temperature Sensor) is located in the engine fuel passage from the fuel tank.

It detects the fuel temperature and relays signals to the ECM.

It employs a thermistor, which is sensitive to changes in the fuel temperature.

The electric resistance of a thermistor decreases as the temperature increases, and increases as the temperature decreases.

The power source in the ECM is supplied to the FTS via a resistor in the ECM.

It is used during injection control strategies that make corrections depending on the fuel temperature and in order to protect the system in event of excessive fuel temperature.

In case of more than FTS 120°C, the engine symptom generates the power loss or poor acceleration.

DTC DESCRIPTION

If the signal is below threshold value, the ECM judged this as a fault and DTC is set.

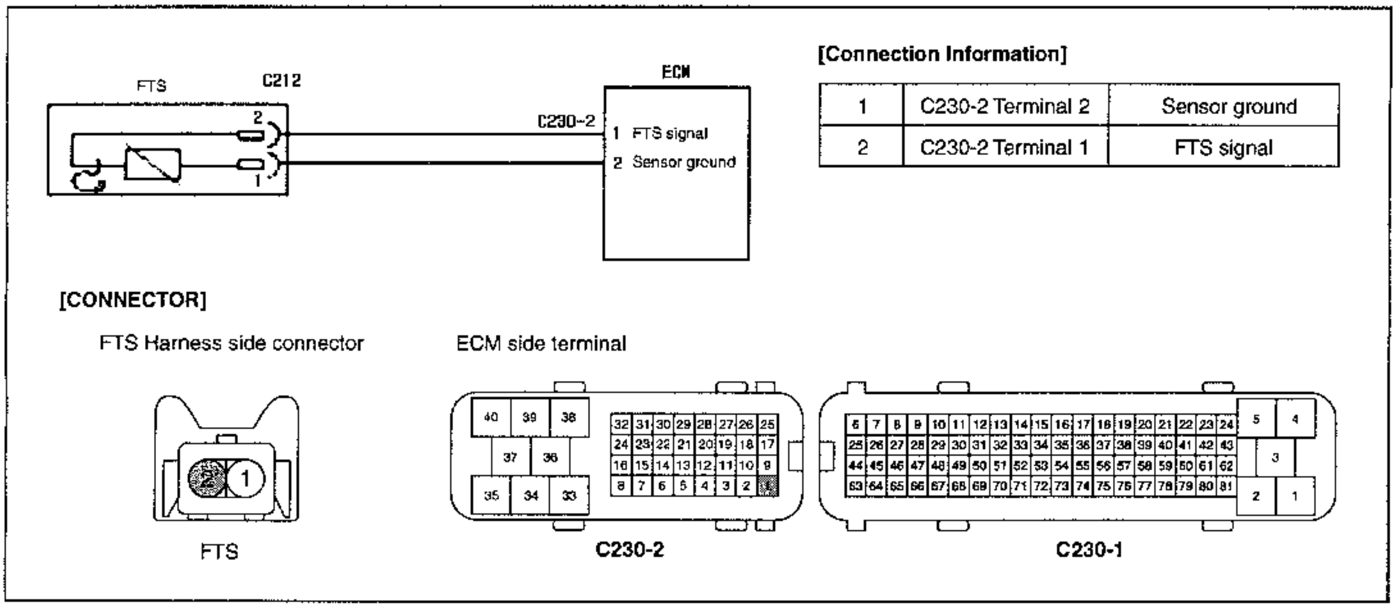
DTC DETECTING CONDITION EED4B2DE

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal check, low	• Short to ground in signal circuit • Faulty FTS • Faulty ECM
Enable Conditions	• Ignition on	
Threshold Value	• Output signal < 112 mV	
Diagnostic Time	• 0.48 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• No • No • No • Yes	
Fail safe	• Engine fuel temperature is fixed at value of 60°C by ECM.	

SPECIFICATION EB748072

IATS			
Temperature (°C)	20	40	60
Resistance (kΩ)	2.27 ~ 2.73	1.06 ~ 1.28	0.54 ~ 0.65

SCHEMATIC DIAGRAM EFEB4E73

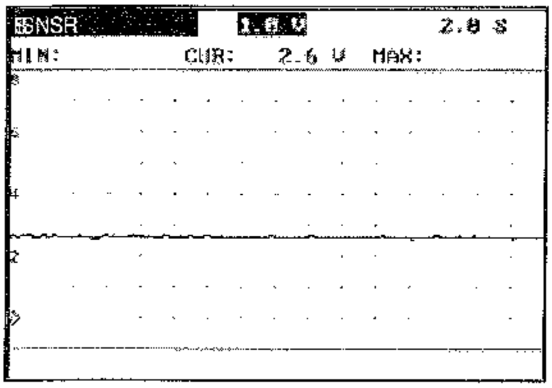


[Connection Information]

1	C230-2 Terminal 2	Sensor ground
2	C230-2 Terminal 1	FTS signal

EC182-2

SIGNAL WAVEFORM E0463C89



Like a ECTS, FTS signals should be smooth and continuous without any sudden changes.
When the fuel temperature is cold, FTS output signals increase and when the fuel temperature is hot, FTS output signals decrease.

E0182-3

MONITOR SCANTOOL DATA E0796B98

1. Connect scantool to Data Link Cable (DLC).
2. Warm up engine to normal operating temperature.
3. Monitor "Fuel Temperature Sensor" parameter on the scantool.

FIG 1

	1.2 CURRENT DATA	
*	INT.AIR TEMP.SNSR	21.6 °C
*	COOLANT TEMP. SENSOR	75.5 °C
*	ENGINE SPEED	821 rpm
*	FUEL TEMP.SENSOR	31.1 °C
	FUEL PRESSURE	278.7bar
	FUEL PRESS. REGULATOR	16.7 %
	EGR ACTUATOR	5.0 %
	INLET THROTTLE ACTU.	5.0 %

FIX SCRN FULL PART GRPH HELP

Fig 1) Signal decreases with increasing sensor temperature and increases with decreasing sensor temperature.

Is the Current data displayed correctly ?

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "W/Harness Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION E5F02FF3

1. Many malfunctions in the electrical system are caused by poor harness and terminals.

   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

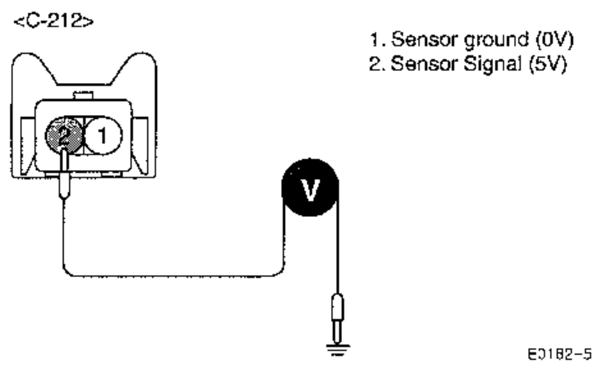
NO

Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION E17E97AC

1. Ignition "OFF"
2. Disconnect FT sensor connector.
3. Measure voltage between terminal 2 of the sensor harness connector and chassis ground.

Specification : 4.8 ~ 5.1V



4. Is the measured voltage within specifications ?

YES

▶ Go to "Component Inspection" procedure.

NO

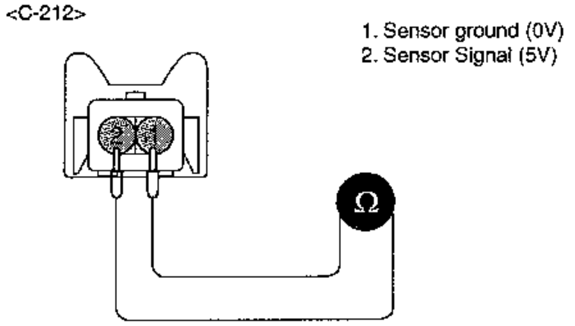
▶ Check for short to ground in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure

COMPONENT INSPECTION E0BC0C16

1. Check Fuel Temperature Sensor
   1) Ignition "OFF"
   2) Disconnect FTS connector.
   3) Measure resistance between terminals 1 and 2 of the FT sensor connector(Component side).

SPECIFICATION :

Temperature (°C)	20	40	60
Resistance (kΩ)	2.27 ~ 2.73	1.06 ~ 1.28	0.54 ~ 0.65



E0182-6

4) Is the measrued resistance within specifications ?

YES

▶ Substitute with a known-good ECM and check for proper operation.
If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Substitute with a known-good FTS and check for proper operation.
If the problem is corrected, replace FTS and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E8DEC2A5

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle within DTC Enable conditions in General information.
3. Are any DTCs present ?

YES

Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

DTC P0183 | FUEL TEMPERATURE SENSOR - HIGH INPUT

COMPONENT LOCATION E36EFA2A

Refer to DTC P0182.

DESCRIPTION EBB66AAE

GENERAL DESCRIPTION

Refer to DTC P0182.

DTC DESCRIPTION

If the signal is above threshold value, the ECM judged this as a fault and DTC is set.

DTC DETECTING CONDITION ED7B8711

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal check, high	• Short to ground in signal circuit • Open in ground circuit • Faulty FTS • Faulty ECM
Enable Conditions	• Ignition on	
Threshold Value	• Output signal > 4.9V	
Diagnostic Time	• 0.48 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• No • No • No • Yes	
Fail safe	• Engine fuel temperature is fixed at value of 60°C by ECM.	

SPECIFICATION EC3C5423

IATS			
Temperature (°C)	20	40	60
Resistance (kΩ)	2.27 ~ 2.73	1.06 ~ 1.28	0.54 ~ 0.65

SCHEMATIC DIAGRAM EFDC3BB8

Refer to DTC P0182.

SIGNAL WAVEFORM EAACCA3D

Refer to DTC P0182.

MONITOR SCANTOOL DATA EBF82ECB

Refer to DTC P0182.

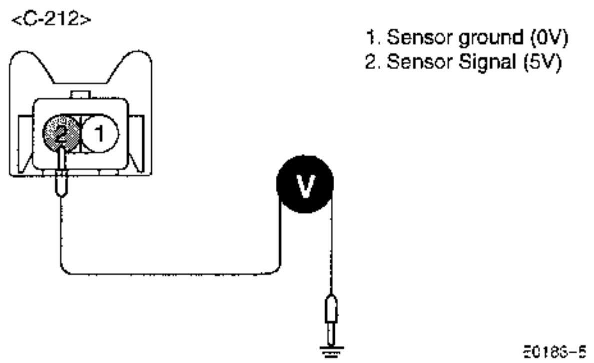
TERMINAL & CONNECTOR INSPECTION EBB1D5CA

Refer to DTC P0182.

SIGNAL CIRCUIT INSPECTION EE32A25D

1. Ignition "OFF"
2. Disconnect FT sensor connector.
3. Measure voltage between terminal 2 of the sensor harness connector and chassis ground.

Specification : 4.8 ~ 5.1V



4. Is the measured voltage within specifications ?

YES

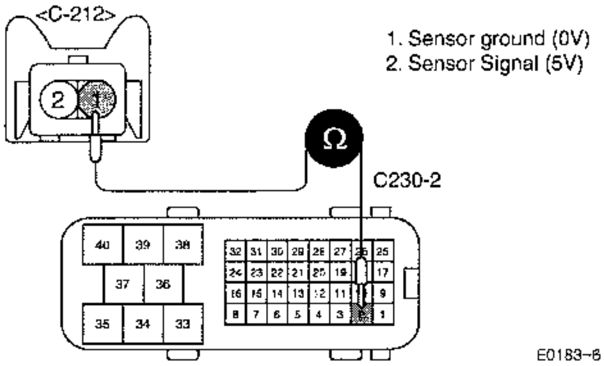
▶ Go to "Component Inspection" procedure.

NO

▶ Check for short to ground in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure

GROUND CIRCUIT INSPECTION E32FEA66

1. Ignition "OFF".
2. Disconnect FT sensor connector and ECM connector.
3. Measure resistance between terminal 1 of the sensor harness connector and terminal 2 of ECM harness connector.



4. Is the measured resistance within specifications ?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Check for open in harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EEE6F7DF

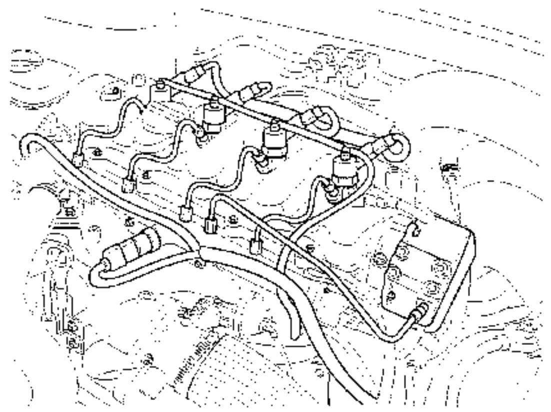
Refer to DTC P0182.

VERIFICATION OF VEHICLE REPAIR E437FC7A

Refer to DTC P0182.

DTC P0190 | FUEL RAIL PRESSURE SENSOR CIRCUIT

COMPONENT LOCATION E9C74BED



E0190-1

DESCRIPTION E1A74AFB

GENERAL DESCRIPTION

RPS(Rail Pressure Sensor) used to transmit to the ECM the pressure value for the rail. The rail is a high pressure accumulator. In order to output a voltage signal to the ECM which is directly proportional to the applied pressure,the rail pressure sensor must measure the instaneous pressure in the rail.

The fuel flows to the rail pressure sensor through opening in the rail, the end of which is sealed off by the sensor diaphram.

Pressurized fuel reaches the sensor's diaphram through a blind hole.

The sensor element (semi conductor device) for convertering the pressure to an electric signal is mounted on this diaphram.

The signal generated by the sensor is inputted to an evaluation circuit which amplifies the measuring signal and sends it to the ECM. This value is used in calculating the flow and injection advance.

In case of RPS failure, the engine symptoms will occur the running engine stall and the starting impossible.

DTC DESCRIPTION

If the signal exceeds threshold value, the ECM judged this as a fault and DTC is set.

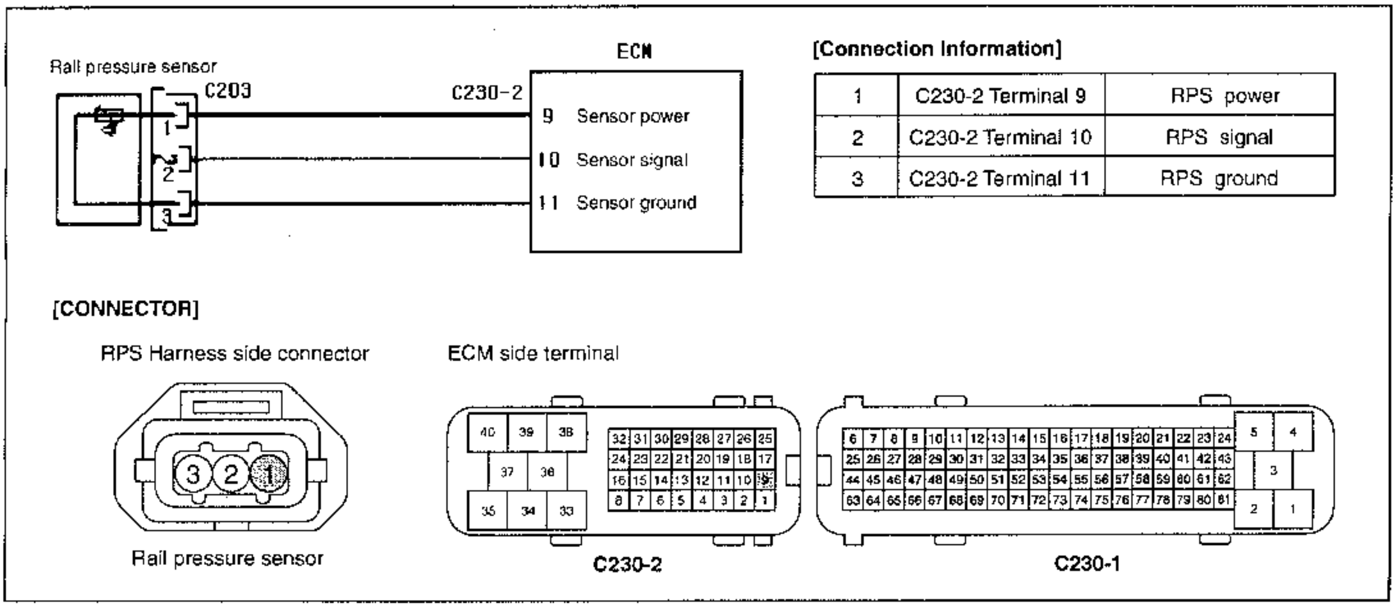
DTC DETECTING CONDITION E98BBE99

Item	Detecting Condition	Possible Cause
DTC Strategy	• Voltage range check	• Short to ground power circuit • Short to battery in power circuit • Open in power • Faulty RPS • Faulty ECM
Enable Conditions	• Engine run	
Threshold Value	• 4.7 V < Sensor supply voltage < 5.1 V	
Diagnostic Time	• 0.1 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• Yes • Yes • No • No	
Fail safe	• Rail pressure is fixed at value of 400 bar by ECM. • Engine shut down • Starting impossible	

SPECIFICATION EB1DD598

	RPS	
	Engine idle state	Fully acceleration (100%)
Rail Pressure	220 ~ 320 bar (22 ~ 32 Mpa)	1500 bar (150 Mpa)
Signal Voltage	Below 1.7 V	Approx. 4.5 V

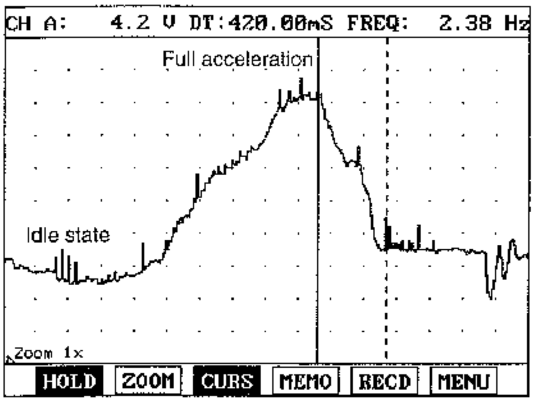
SCHEMATIC DIAGRAM EE2DBB03



1	C230-2 Terminal 9	RPS power
2	C230-2 Terminal 10	RPS signal
3	C230-2 Terminal 11	RPS ground

E0190-3

SIGNAL WAVEFORM EC13F91C



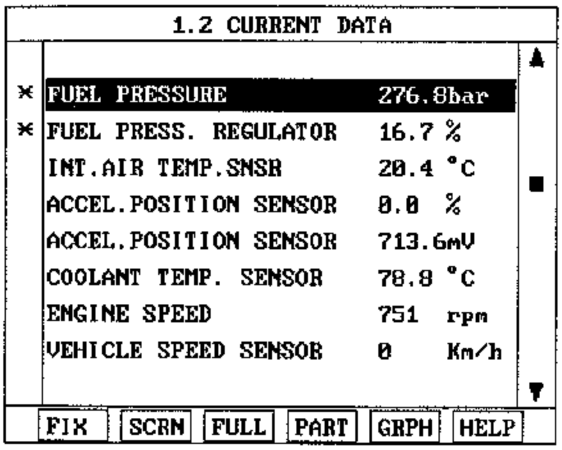
This test should be inspected after depressing the HOLD mode from run after the sudden acceleration.
RPS signal voltage is less than 1V to over 4.5V
The waveform pattern become increasing upward rapidly when the engine speed increases.

E0190-4

MONITOR SCANTOOL DATA E7D9AEAE

1. Connect scantool to Data Link Cable (DLC).
2. Warm up engine to normal operating temperature.
3. Monitor "Fuel Pressure Sensor" parameter on the scantool.

FIG 1



1.2 CURRENT DATA

*	FUEL PRESSURE	276.8bar
*	FUEL PRESS. REGULATOR	16.7 %
	INT.AIR TEMP.SNSR	20.4 °C
	ACCEL.POSITION SENSOR	0.0 %
	ACCEL.POSITION SENSOR	713.6mV
	COOLANT TEMP. SENSOR	78.8 °C
	ENGINE SPEED	751 rpm
	VEHICLE SPEED SENSOR	0 Km/h

FIX SCRN FULL PART GRPH HELP

Fig 1) Normal value at idle speed.

Is the Current data displayed correctly ?

YES

Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "W/Harness Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION EAF335BD

1. Many malfunctions in the electrical system are caused by poor harness and terminals.

   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

Repair as necessary and go to "Verification Vehicle Repair" procedure.

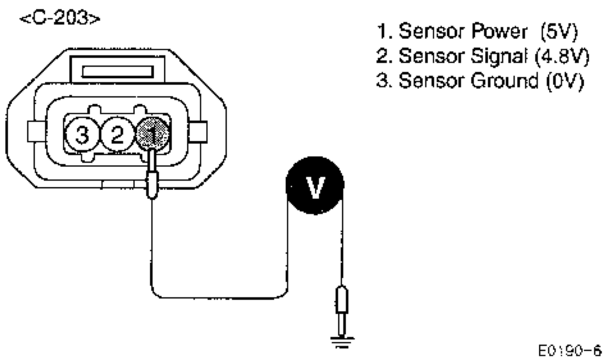
NO

Go to "Power Circuit Inspection" procedure.

POWER CIRCUIT INSPECTION ED03822A

1. Check for short in harness
   1) Ignition "OFF"
   2) Disconnect FT sensor connector
   3) Ignition "ON" & Engine "OFF"
   4) Measure voltage between terminal 1 of the sensor harness connector and chassis ground

Specification : 5V



   5) Is the measured voltage within specifications ?

YES

▶ Go to "Ground Circuit Inspection" procedure.

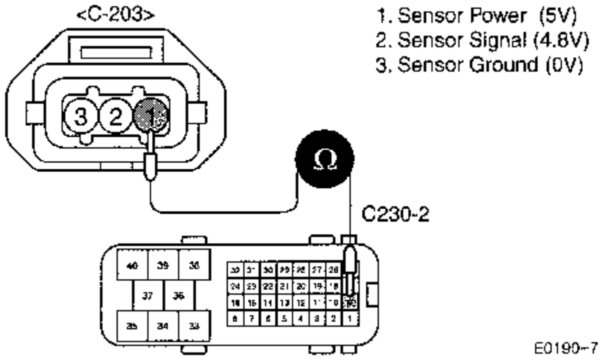
NO

▶ Check for short to battery in harness. Repair as necessary and go to "Verification vehicle Repair" procedure

2. Check for open in harness
   1) Ignition "OFF"
   2) Disconnect FT sensor connector

3) Measure resistance between terminal 1 of the sensor harness connector and terminal 9 of ECM harness connector.

Specification : Approx. below 1Ω



COMPONENT INSPECTION E29A5AC1

1. Visual inspection
   1) Check installation torque and leakage around Fuel Rail Pressure Sensor.
   2) Check for damaged harness and terminals: contact resistance, oxidation, bent or broken terminals.
   3) Check deform or crack on Fuel Rail Pressure Sensor.

Installation Torque : 35 ± 2 Nm

   4) Is the Fuel Rail Pressure sensor visually O.K ?

YES

▶ Substitute with a known-good ECM and check for proper operation.
If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Substitute with a known-good Fuel Rail Pressure Sensor and check for proper operation.
If the problem is corrected, replace Fuel Rail Pressure Sensor and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EF75CE4E

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle within DTC Enable conditions in General information.
3. Are any DTCs present ?

YES

Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

DTC P0192 | FUEL RAIL PRESSURE SENSOR - LOW INPUT

COMPONENT LOCATION E3087D4D

Refer to DTC P0190.

DESCRIPTION E8A9BBDA

GENERAL DESCRIPTION

Refer to DTC P0190.

DTC DESCRIPTION

If the signal is below threshold value, the ECM judged this as a fault and DTC is set.

DTC DETECTING CONDITION ECAD99D1

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal check, low	• Short to ground in signal circuit • Faulty RPS • Faulty ECM
Enable Conditions	• Engine run	
Threshold Value	• Output signal < 180.8 mV	
Diagnostic Time	• 0.18 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• Yes • Yes • No • No	
Fail safe	• Rail pressure is fixed at value of 400 bar by ECM. • Engine shut down • Starting impossible	

SPECIFICATION EE5B1E64

RPS		
	Engine idle state	Fully acceleration (100%)
Rail Pressure	220 ~ 320 bar (22 ~ 32 Mpa)	1500 bar (150 Mpa)
Signal Voltage	Below 1.7 V	Approx. 4.5 V

SCHEMATIC DIAGRAM EBEE45E3

Refer to DTC P0190.

SIGNAL WAVEFORM E69E9B78

Refer to DTC P0190.

MONITOR SCANTOOL DATA EB84608E

Refer to DTC P0190.

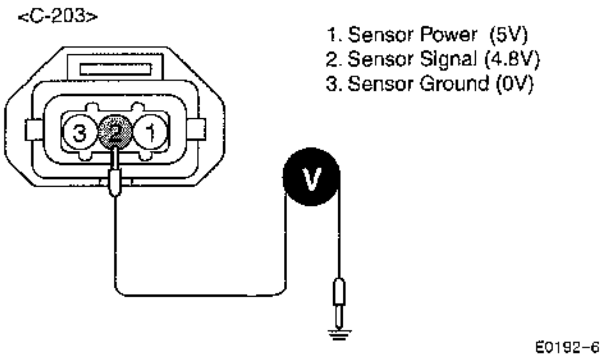
TERMINAL & CONNECTOR INSPECTION E0DFD7F5

Refer to DTC P0190.

SIGNAL CIRCUIT INSPECTION ECFB8CF4

1. Ignition "OFF"
2. Disconnect FT sensor connector.
3. Ignition "ON" & Engine "OFF"
4. Measure voltage between terminal 2 of the sensor harness connector and chassis ground.

Specification : 4.8 ~ 5.1V



5. Is the measured voltage within specifications ?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Check for short to ground in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EFAB320F

Refer to DTC P0190.

VERIFICATION OF VEHICLE REPAIR EAEBB0A6

Refer to DTC P0190.

DTC P0193 | FUEL RAIL PRESSURE SENSOR - HIGH INPUT

COMPONENT LOCATION E6461E1B

Refer to DTC P0190.

DESCRIPTION E270DD2B

GENERAL DESCRIPTION

Refer to DTC P0190.

DTC DESCRIPTION

If the signal is above threshold value, the ECM judged this as a fault and DTC is set.

DTC DETECTING CONDITION E7F00BBD

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal check, high	• Short to ground in signal circuit • Open in signal harness • Faulty RPS • Faulty ECM
Enable Conditions	• Engine run	
Threshold Value	• Output signal > 4.8 V	
Diagnostic Time	• 0.18 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• Yes • Yes • No • No	
Fail safe	• Rail pressure is fixed at value of 400 bar by ECM. • Engine shut down • Starting impossible	

SPECIFICATION E37EE0C7

RPS		
	Engine idle state	Full acceleration (100%)
Rail Pressure	220 ~ 320 bar (22 ~ 32 Mpa)	1500 bar (150 Mpa)
Signal Voltage	Below 1.7 V	Approx. 4.5 V

SCHEMATIC DIAGRAM EDBCFEC0

Refer to DTC P0190.

SIGNAL WAVEFORM ECF5F4DB

Refer to DTC P0190.

MONITOR SCANTOOL DATA EF9D4257

Refer to DTC P0190.

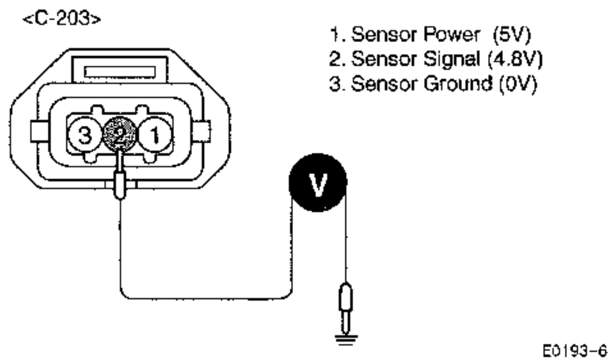
TERMINAL & CONNECTOR INSPECTION EB55C05C

Refer to DTC P0190.

SIGNAL CIRCUIT INSPECTION E83A27E0

1. Check for short to battery in harness
    1) Ignition "OFF".
    2) Disconnect FT sensor connector.
    3) Ignition "ON" & Engine "OFF".
    4) Measure voltage between terminal 2 of the sensor harness connector and chassis ground.

    Specification : 4.8 ~ 5.1V



    5) Is the measured voltage within specifications ?

YES

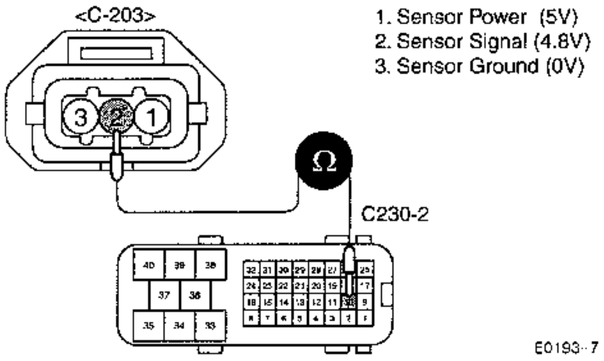
▶ Go to "Check for open in harness" procedure.

NO

▶ Check for short to battery in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for open in harness
   1) Ignition "OFF"
   2) Disconnect FT sensor connector.
   3) Measure resistance between terminal 2 of the sensor harness connector and terminal 10 of ECM harness connector.

Specification : Approx.below 1Ω



   4) Is the measured resistance within specifications ?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Check for open in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EB6CDD79

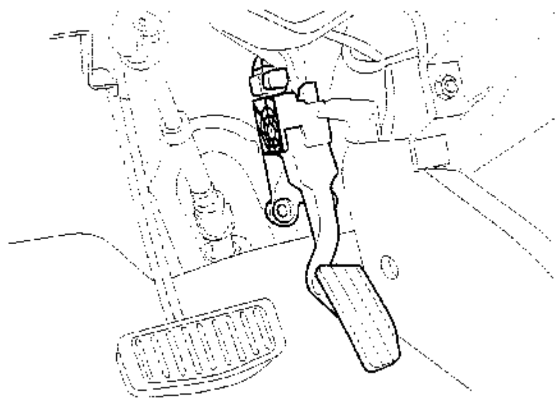
Refer to DTC P0190.

VERIFICATION OF VEHICLE REPAIR EEE4A2EC

Refer to DTC P0190.

DTC P0220 | ACCELERATOR POSITION SENSOR 2 CIRCUIT

COMPONENT LOCATION E3E1EFFC



E0220-1

DESCRIPTION E718FE9E

GENERAL DESCRIPTION

APS(Acceleration Position Sensor) is measured the driver's acceleration using a potentiometer and APS signal is transmitted to the ECM. The pedal's position is calculated from the voltage of potentiometer in the APS.

The absence of a mechanical link between the accelertor pedal and injection system presents a risk of loss of control of the engine in the event of a failure of the component in the charge of providing the driver's request information to the injection system.

Therefore, APS has the two potentiometers whose slides are mechanically solid.

APS 2 is for plausibility of load request signal and decide whether or not APS 1 & 2 is malfunctioning.

DTC DESCRIPTION

If the signal exceeds threshold value, the ECM judged this as a fault and DTC is set.

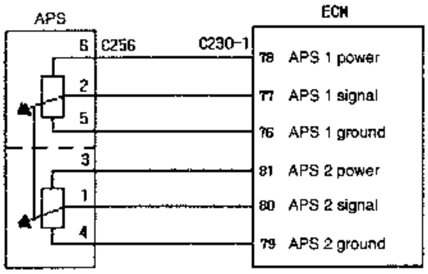
DTC DETECTING CONDITION E426D6B8

Item	Detecting Condition	Possible Cause
DTC Strategy	• Voltage range check	• Short to ground in power circuit • Short to battery in power circuit • Open in power circuit • Faulty APS 2 • Faulty ECM
Enable Conditions	• Engine run	
Threshold Value	• 4.7 V < Sensor supply voltage < 5.1 V	
Diagnostic Time	• 0.1 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• Yes • Yes • No • No	
Fail safe	• Engine speed is fixed at 1200 rpm without accel pedal sensor action. • Engine performance is reduced • Air conditioning system is deactivited as against the vehicle speed and the engine rpm • Cruise control system inhibited	

SPECIFICATION E9CD1333

APS		
Accel pedal position	Idle Position (0%)	Fully acceleration (100%)
Signal votage	0.2 ~ 0.5 V	1.6 ~ 2.5 V

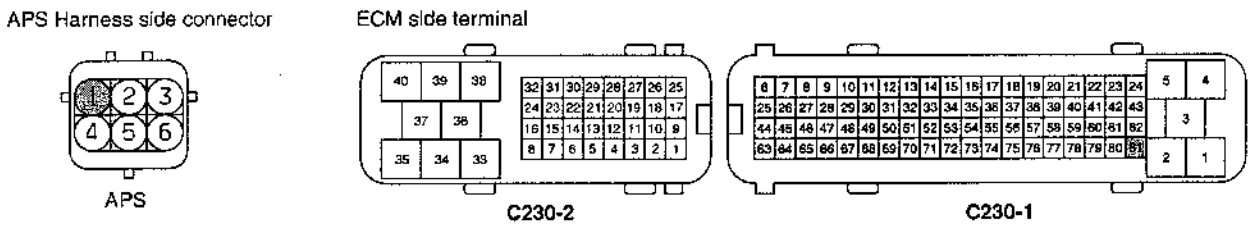
SCHEMATIC DIAGRAM EDBC8ACC



[Connection Information]

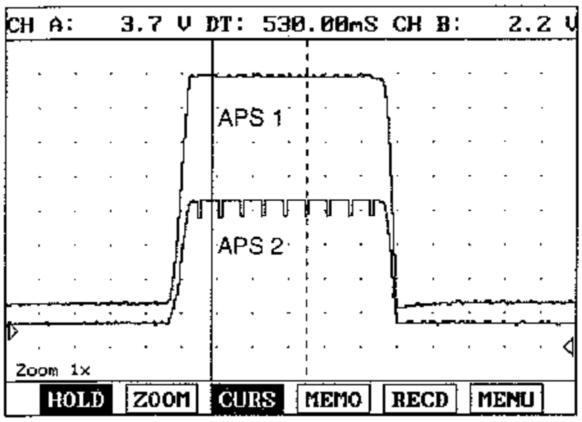
1	C230-1 Terminal 76	APS 1 ground
2	C230-1 Terminal 77	APS 1 signal
3	C230-1 Terminal 78	APS 1 power
4	C230-1 Terminal 79	APS 2 ground
5	C230-1 Terminal 80	APS 2 signal
6	C230-1 Terminal 81	APS 2 power

[CONNECTOR]



E0220-2

SIGNAL WAVEFORM E3A76F4E



This test should be inspected after depressing the HOLD mode from run after the sudden acceleration.
As accel pedal is pressed down fully, the intensity of the APS 1 & 2 waveform increases individually.
APS 1 signal voltage is less than 1V to over 4V and APS 2 is 1/2 voltage as against APS 1 voltage.
The waveform pattern become increasing upward rapidly when the engine speed increases.

F0220-3

MONITOR SCANTOOL DATA EEC10D58

1. Connect scantool to Data Link Cable (DLC).
2. Warm up engine to normal operating temperature.
3. Monitor "Acceleration Position Sensor" parameter on the scantool.

FIG 1

	1.2 CURRENT DATA		
*	ACCEL.POSITION SENSOR	27.4	%
*	ACCEL.POSITION SENSOR	1603.	mV
	BATTERY VOLTAGE	14.2	V
	MASS AIR FLOW	354	mg/st
	INT.AIR TEMP.SNSR	20.2	°C
	COOLANT TEMP. SENSOR	52.0	°C
	ENGINE SPEED	2182	rpm
	VEHICLE SPEED SENSOR	0	Km/h

FIX SCRN FULL PART GRPH HELP

Fig 1) Signal increases when depressing accel pedal.

Is the Current data displayed correctly ?

YES

Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "W/Harness Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION EB4B5CDC

1. Many malfunctions in the electrical system are caused by poor harness and terminals.
   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

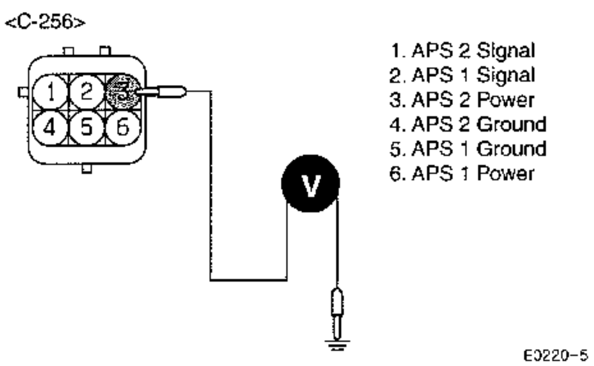
NO

Go to "Power Circuit Inspection" procedure.

POWER CIRCUIT INSPECTION EB3920E4

1. Check for short in harness
   1) Ignition "OFF".
   2) Disconnect FT sensor connector.
   3) Ignition "ON" & Engine "OFF".
   4) Measure voltage between terminal 3 of the sensor harness connector and chassis ground.

Specification : 4.8 ~ 5.1V



   5) Is the measured voltage within specifications ?

YES

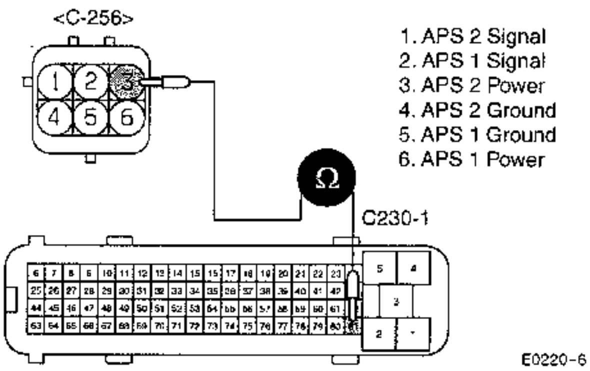
▶ Go to "Check for open in harness" procedure.

NO

▶ Check for short to in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for open in harness
   1) Ignition "OFF".
   2) Disconnect FT sensor connector.
   3) Measure resistance between terminal 3 of the sensor harness connector and terminal 81 of ECM harness connector.

Specification : Approx.below 1Ω



   4) Is the measured resistance within specifications ?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Check for open in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E1FD3F7E

1. Check APS
   1) Ignition "OFF".
   2) Disconnect APS connector.
   3) Measure resistance between terminals 3 and 6 of the sensor connector(to IAT sensor side).

Specification : 1.7kΩ ± 0.8kΩ (20°C)

   4) Is the measured resistance within specifications ?

YES

▶ Substitute with a known-good ECM and check for proper operation.
If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Substitute with a known-good APS2 and check for proper operation.
If the problem is corrected, replace APS2 and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E5AFE6ED

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle within DTC Enable conditions in General information.
3. Are any DTCs present ?

YES

Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

DTC P0223 | ACCELERATION POSITION SENSOR 2 - HIGH INPUT

COMPONENT LOCATION E0B9BC80

Refer to DTC P0220.

DESCRIPTION E6BEF191

GENERAL DESCRIPTION

Refer to DTC P0220.

DTC DESCRIPTION

If the signal is exceeds threshold value, the ECM judged this as a fault and DTC is set.

DTC DETECTING CONDITION EC9178F7

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal check, high	• Short to battery in signal circuit • Open in signal circuit • Open in ground circuit • Faulty APS 2 • Faulty ECM
Enable Conditions	• Ignition on	
Threshold Value	• Output signal > 2.464V	
Diagnostic Time	• 0.18 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• Yes • Yes • No • No	
Fail safe	• Engine speed is fixed at 1200 rpm without accel pedal sensor action. • Engine performance is reduced. • Air conditioning system is deactivited as against the vehicle speed and the engine rpm. • Cruise control system inhibited	

SPECIFICATION EE24ADA6

APS		
Accel pedal position	Idle Position (0%)	Fully acceleration (100%)
Signal votage	0.2 ~ 0.5 V	1.6 ~ 2.5 V

SCHEMATIC DIAGRAM EB356C11

Refer to DTC P0220.

SIGNAL WAVEFORM EF3BBABB

Refer to DTC P0220.

MONITOR SCANTOOL DATA E1EFCF25

Refer to DTC P0220.

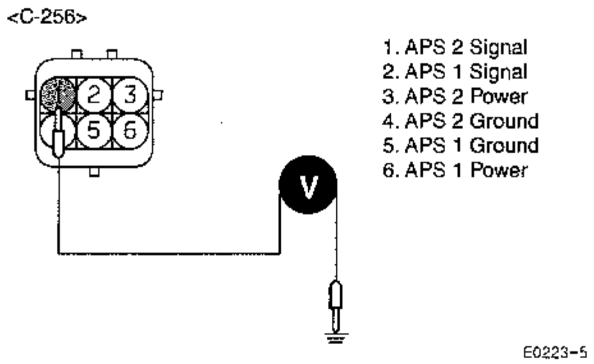
TERMINAL & CONNECTOR INSPECTION EDABED24

Refer to DTC P0220.

SIGNAL CIRCUIT INSPECTION EA1BBCCF

1. Check for short to battery in harness
   1) Ignition "OFF".
   2) Disconnect AP sensor connector.
   3) Ignition "ON" & Engine "OFF".
   4) Measure voltage between terminal 1 of the sensor harness connector and chassis ground

   Specification : 4.8 ~ 5.1V



   5) Is the measured voltage within specifications ?

   YES

   ▶ Go to "Check for open in harness" as below.

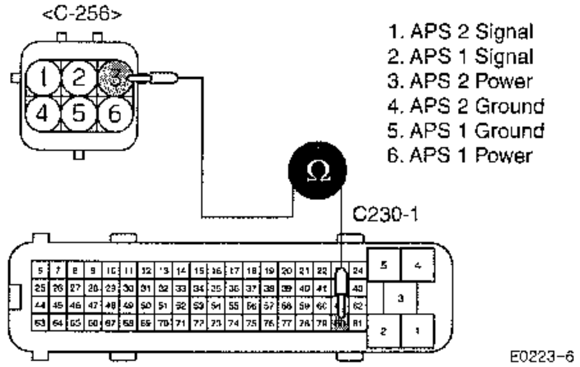
   NO

   ▶ Check for short to battery in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for open in harness
   1) Ignition "OFF"
   2) Disconnect AP sensor connector

3) Measure resistance between terminal 1 of the sensor harness connector and terminal 80 of ECM harness connector.

Specification : Approx.below 1Ω



4) Is the measured resistance within specifications ?

YES

▶ Go to "Ground Circuit Inspection" procedure.

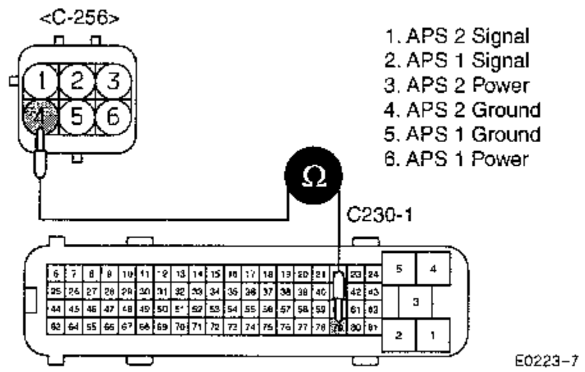
NO

5) ▶ Check for open in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION EE10F1C9

1. Ignition "OFF".
2. Disconnect AP sensor connector.
3. Measure resistance between terminal 4 of the sensor harness connector and terminal 79 of ECM harness connector.

Specification : Approx.below 1Ω



4. Is the measured resistance within specifications ?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Check for open in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E0D7AFCB

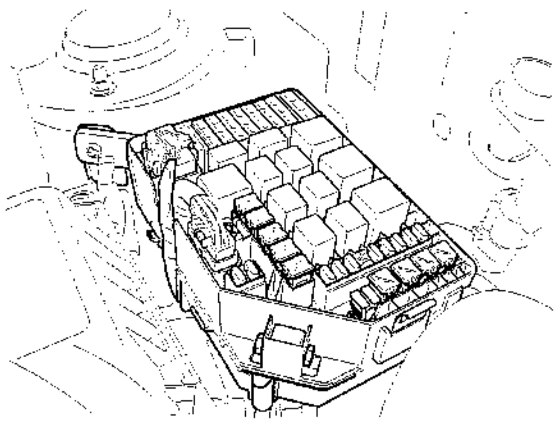
Refer to DTC P0220.

VERIFICATION OF VEHICLE REPAIR E81EB5DC

Refer to DTC P0220.

DTC P0231 | ELECTRIC FUEL PUMP CIRCUIT LOW

COMPONENT LOCATION E81DA8DD



P0231-1

DESCRIPTION E6AF137D

GENERAL DESCRIPTION

The voltage after the fuel pump relay is used to supply power to the electric fuel pump in the low pressure line.

When the ignition switch is in starting position, the battery voltage is supplied from the fuel pump relay to the ECM.

When the ignition switch is turned on, current flows from the ignition switch through the current the fuel pump relay coil to ground by the ECM. And then, the voltage is supplied to the electric fuel pump to drive.

In case of the fuel pump relay failure, the engine symptoms will occur the running engine stall and the starting impossible.

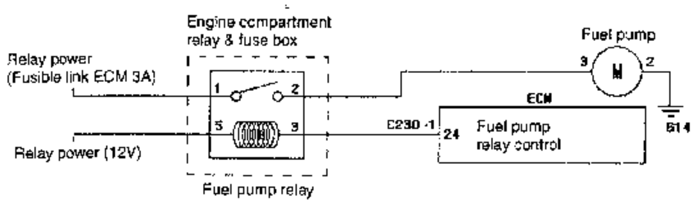
DTC DESCRIPTION

If the signal exceeds threshold value, the ECM judged this as a fault and DTC is set.

DTC DETECTING CONDITION E2A205B5

Item	Detecting Condition	Possible Cause
DTC Strategy	• Circuit continuity check	• Contact resistance in connectors • Open in power circuit • Open or short to ground in relay control circuit • Fuse blown • Faulty relay • Faulty ECM
Enable Conditions	• Ignition on	
Threshold Value	• Open or short for relay control circuit	
Diagnostic Time	• 0.48 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• No • No • No • No	

SCHEMATIC DIAGRAM EE3CB80C



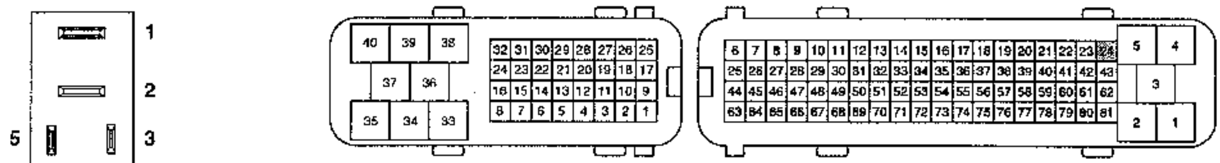
[Connection Information]

1	E18 Terminal 95	Relay power
2	F22 Terminal 3	Fuel pump power supply
3	C230-1 Terminal 24	Fuel pump relay control
4	-	-
5	E18 Terminal 103	Relay coil power

[CONNECTOR]

Fuel pump relay Harness side connector

ECM side terminal

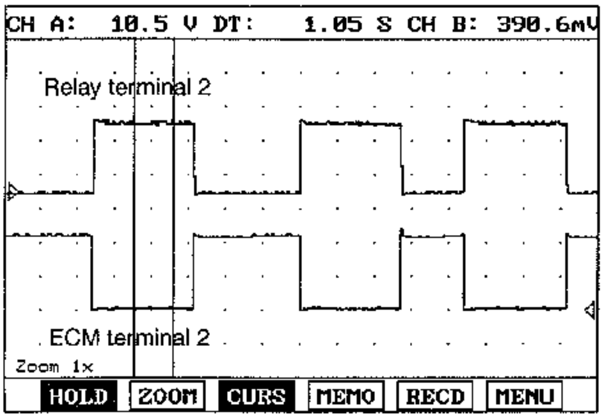


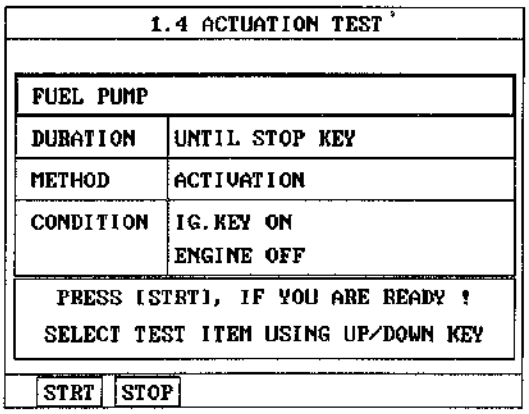
Fuel pump relay

C230-2

C230-1

SIGNAL WAVEFORM E4CCB576





This test should be inspected after depressing the HOLD mode after turning the ignition switch ON and OFF several times. When the ground is connected to the terminal 24/C230-1 by the ECM the battery voltage is supplied to the electric fuel pump through the relay terminal 2.
Battery voltage is applied to the electrical fuel pump for approx. 3 seconds when the ignition switch is turned on and fuel delivery noise can be heard. For checking the wire and the fuel pump relay with fuse to the fuel pump, the START key should be pressed in the scan tool actuation test mode.
And then make sure that the relay "click" noise could be heard with the change of the fuel pump pressure.
Also, the fuel pressure should be increased above 3.5 bar when turning the ignition switch ON.

E0231-3

MONITOR SCANTOOL DATA E27B6DE3

1. Connect scantool to Data Link Cable (DLC).
2. Monitor " Fuel Pump Relay " parameter on the scantool.

FIG 1

1.2 CURRENT DATA			
×	FUEL PRESSURE	3.6	bar
×	FUEL PUMP RELAY	ON	
	BOOSTER V-OPERAT'G INJ	0.6	V
	MIL(ENGINE CHECK)	ON	
	GLOW RELAY	ON	
	FUEL QUANTITY	26	mcc
	FAN-LOW SPEED	OFF	
	FAN-HIGH SPEED	OFF	

FIX | SCRN | FULL | PART | GRPH | HELP

Fig 1) Fuel pump relay ON for approx. 3 seconds when turning the ignition switch ON.

Is the Current data displayed correctly ?

YES

Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaire and ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "W/Harness Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION EE76C3A5

1. Many malfunctions in the electrical system are caused by poor harness and terminals.

   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

   YES

   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

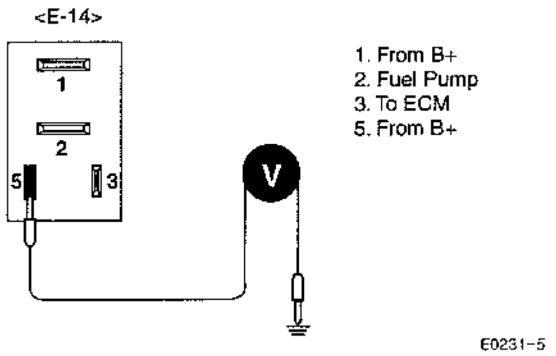
   NO

   Go to "Power Circuit Inspection" procedure.

POWER CIRCUIT INSPECTION E51FCAC2

1. Ignition "OFF".
2. Disconnect Fuel Pump Relay.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 5 of the Fuel Pump Relay harness connector and chassis ground.

Specification : B+



5. Is the measured voltage within specifications ?

YES

▶ Go to "Control Circuit Inspection" procedure.

NO

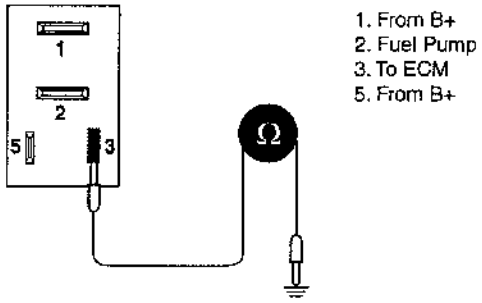
▶ Check for open in power harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION ED1E7078

1. Check for short to ground in harness
   1) Ignition "OFF".
   2) Disconnect Fuel Pump Relay and ECM connector.

3) Measure resistance between terminal 3 of the Fuel Pump Relay harness connector and Chassis ground.

Specification : Infinite



E0231-6

4) Is the measured resistance within specifications ?

YES

▶ Go to "Check for open in control harness" as below.

NO

▶ Check for short to ground in control harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure

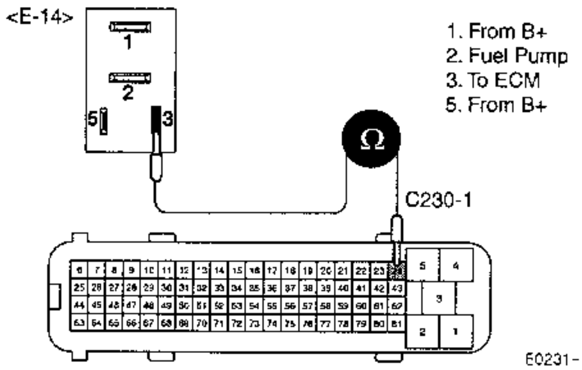
2. Check for open in control harness

1) Ignition "OFF".

2) Disconnect Fuel Pump Relay and ECM connector.

3) Measure resistance between terminal 3 of the Fuel Pump Relay harness connector and terminal 24 of ECM harness connector.

Specification : Approx.below 1Ω



E0231-7

4) Is the measured resistance within specifications ?

YES

▶ Go to "Component Inspection" procedure.

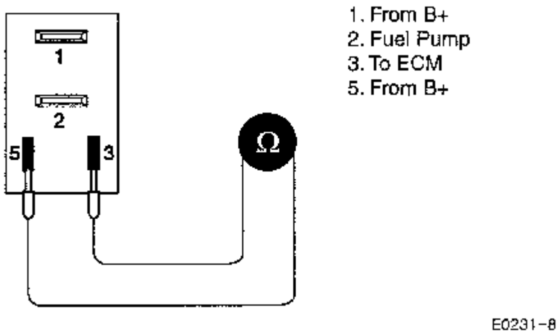
NO

▶ Check for open in control harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EBC99942

1. Check Fuel Pump Relay
   1) Ignition "OFF" & Engine "OFF"
   2) Disconnect Fuel Pump Relay
   3) Measure resistance between terminals 3 and 5 of the Fuel Pump Relay connector (Component side).

   Specification : 90 ~ 100Ω (20°C)



   4) Is the measured resistance within specifications ?

   YES

   ▶ Go to "Check Electric Fuel Pump Relay " as below.

   NO

   ▶ Substitute with a known-good Electric Fuel Pump Relay and check for proper operation.
   If the problem is corrected, replace Electric Fuel Pump Relay and then go to "Verification of Vehicle Repair" procedure.

2. Check Electric Feul Pump Relay operation
   1) Ignition "OFF" & Engine "OFF".
   2) Connect Fuel Pump relay and Disconnect ECM connector.
   3) Ignition "ON" & Engine "OFF".
   4) Ground terminal 24 of ECM harness connector to operate Fuel Pump Relay. Or, Use Actuator Test mode in scantool to operate Electric Fuel Pump Relay.
   5) Is the Fuel Pump Relay operating corrctly ?

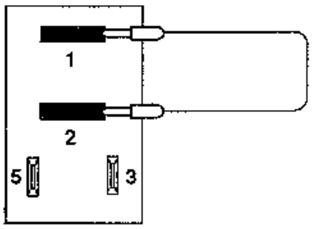
   YES

   ▶ Go to "Check Fuel Pump Power Circuit" as below.

   NO

   ▶ Substitute with a known-good Fuel Pump Relay and check for proper operation.
   If the problem is corrected, replace Fuel Pump Relay and then go to "Verification of Vehicle Repair" procedur-e.

3. Check Electric Feul Pump Power Circuit
   1) Ignition "OFF" & Engine "OFF".
   2) Disconnect Fuel Pump relay.
   3) Jump terminal 2 and 4 of Fuel Pump Relay harness connector with jumper wire.



1. From B+
2. Fuel Pump
3. To ECM
5. From B+

E0231-9

   4) Is operating sound of the Fuel Pump heard ?

YES

▶ Substitute with a known-good Fuel Pump Relay and check for proper operation.
If the problem is corrected, replace Fuel Pump Relay and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Substitute with a known-good ECM and check for proper operation.
If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E9FFEBD5

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle within DTC Enable conditions in General information.
3. Are any DTCs present ?

YES

Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

DTC P0232 | ELECTRIC FUEL PUMP RELAY - SHORT CIRCUIT

COMPONENT LOCATION E68F968F

Refer to DTC P0231.

DESCRIPTION E1AA433C

GENERAL DESCRIPTION

Refer to DTC P0231.

DTC DESCRIPTION

If the signal exceeds threshold value, the ECM judged this as a fault and DTC is set.

DTC DETECTING CONDITION E8F71A45

Item	Detecting Condition	Possible Cause
DTC Strategy	• Circuit continuity check	• Contact resistance in connectors • Short to battery in relay control circuit • Fuse blown • Faulty relay • Faulty ECM
Enable Conditions	• Ignition on	
Threshold Value	• Short for relay control circuit	
Diagnostic Time	• 0.48 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• No • No • No • No	

SCHEMATIC DIAGRAM EA443848

Refer to DTC P0231.

SIGNAL WAVEFORM E5E7DD57

Refer to DTC P0231.

MONITOR SCANTOOL DATA E0881CD1

Refer to DTC P0231.

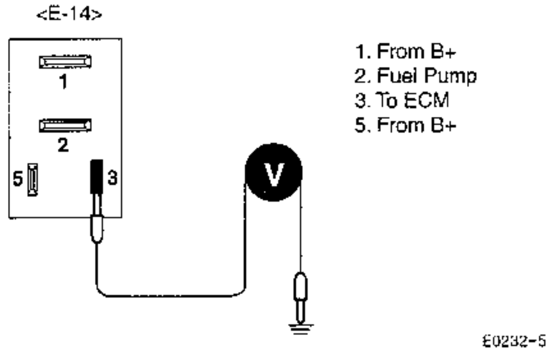
TERMINAL & CONNECTOR INSPECTION ED7DFADB

Refer to DTC P0231.

CONTROL CIRCUIT INSPECTION E3D97878

1. Ignition "OFF".
2. Disconnect Fuel Pump Relay and ECM connector.
3. Igniton "ON" & Engine "OFF".
4. Measure voltage between terminal 3 of the fuel pump relay harness connector and chassis ground.

Specification : Approx. below 1V



5. Is the measured voltage within specifications ?

YES

▶ Go to "Component inspection" procedure.

NO

▶ Check for short to battery in control harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EE83A6E7

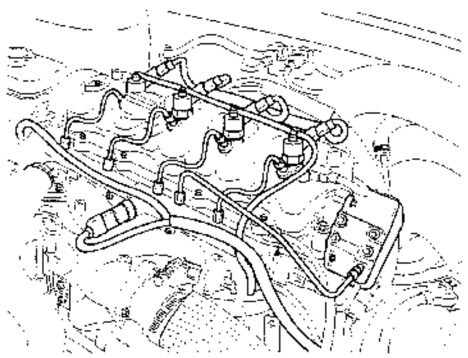
Refer to DTC P0231.

VERIFICATION OF VEHICLE REPAIR EBF35382

Refer to DTC P0231.

DTC P0261 | CYLINDER1-INJECTOR CIRCUIT LOW

COMPONENT LOCATION EFFA2A9B



E0261-1

DESCRIPTION E13E48FD

GENERAL DESCRIPTION

Special injectors with hydraulic servo-system and electrical triggering element (solenoid valve) are used with the common rail system in order to achieve efficient start of injection and precise injected fuel quantity.

Metering and spray preparation of the diesel fuel, as needed by the engine according to the engine map, Realization of pilot and main injection and post injection if required.

Pilot injection is used to reduce the engine noise and vibration and post injection is used to reduce the NO and N0X in the exhaust gas.

Control of injected quantity and injection timing based on the system pressure and enerizing time as actuated by the ECM. The injected fuel quantity is now defined by the injector opening time and rail pressure.

Injection is terminated when the solenoid valve is no longer triggered and closes as a result.

In case of more than 2 injectors failure, the engine symptoms will occur the running engine stall and the starting impossible.

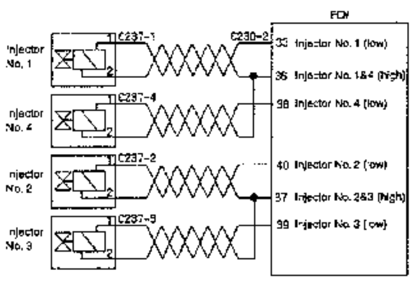
DTC DESCRIPTION

If the signal exceeds threshold value, the ECM judged this as a fault and DTC is set.

DTC DETECTING CONDITION ED6AE6AD

Item	Detecting Condition	Possible Cause
DTC Strategy	• Circuit continuity check	• Short to battery in power circuit • Short to battery in control circuit • Faulty injector • Faulty ECM
Enable Conditions	• Engine run	
Threshold Value	• Overcurrent low side connection : Injector current increases the maximum value of 29.5 A~34 A	
Diagnostic Time	• 0.3 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• Yes • Yes • No • No	

SCHEMATIC DIAGRAM EAEAB3AF



[Connection Information]

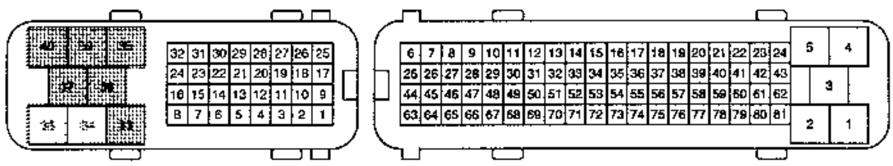
1	C230-2 Terminal 33	Injector low side
2	C230-2 Terminal 36	Injector high side

[CONNECTOR]

Injector Harness side connector

Injector connector

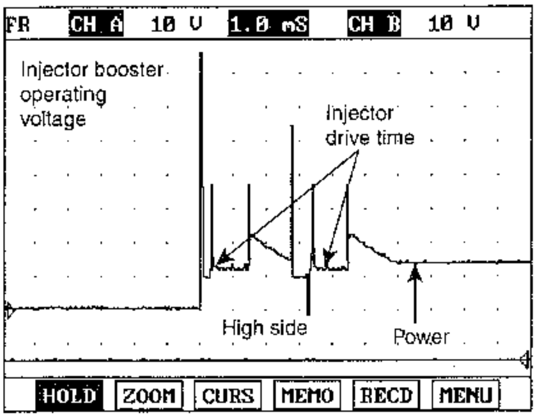
ECM side terminal

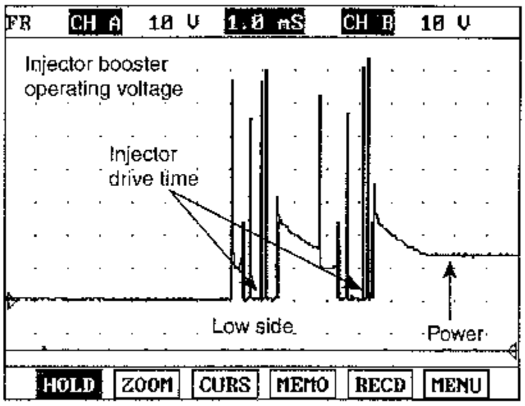


C230-2 C230-1

E0261-2

SIGNAL WAVEFORM E668FAA0





This test should be inspected after depressing the HOLD mode while idling.
At first, the waveform observation points is height of injector coil induced voltage (booster voltage)
In second place, the injector drive time will be checked at the high side.
When the engine speed is suddenly raced the injector drive time extended at first, but the drive time will soon match the engine speed.

E0261-3

MONITOR SCANTOOL DATA EE1C91A3

1. Connect scantool to Data Link Cable (DLC).
2. Warm up engine to normal operating temperature.
3. Monitor that "Injector Booster Operating Voltage" parameter on the scantool.

FIG 1

1.2 CURRENT DATA		
×	MASS AIR FLOW	473 mg/st
×	FUEL PRESSURE	276.8bar
×	FUEL PRESS. REGULATOR	16.5 %
×	BOOSTER V-OPERAT'G INJ	77.8 V
×	FUEL QUANTITY	8 mcc
	ACCEL.POSITION SENSOR	718.5mV
	COOLANT TEMP. SENSOR	83.9 °C
	ENGINE SPEED	752 rpm

FIX | SCRN | FULL | PART | GRPH | HELP

Fig 1) Normal value with injector booster operating voltage (above 70V).

Is the Current data displayed correctly ?

YES

Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "W/Harness Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION E14EB8A2

1. Many malfunctions in the electrical system are caused by poor harness and terminals.

   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

   YES

   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

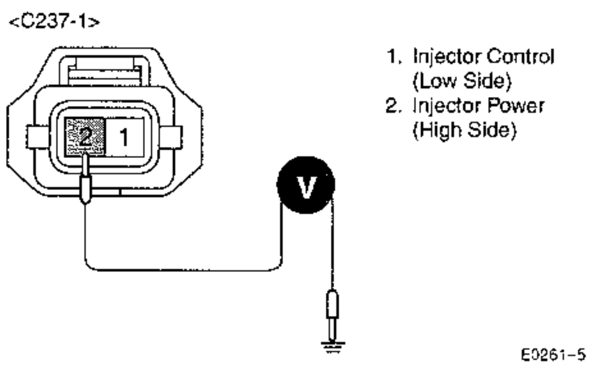
   NO

   Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION E6DE761E

1. Ignition "OFF".
2. Disconnect Fuel Pump Relay.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 2 of the #1 injector and chassis ground.

Specification : Approx. 11.5 ~ 13.5V



5. Is the measured voltage within specifications ?

YES

▶ Go to "Control Circuit Inspection" procedure.

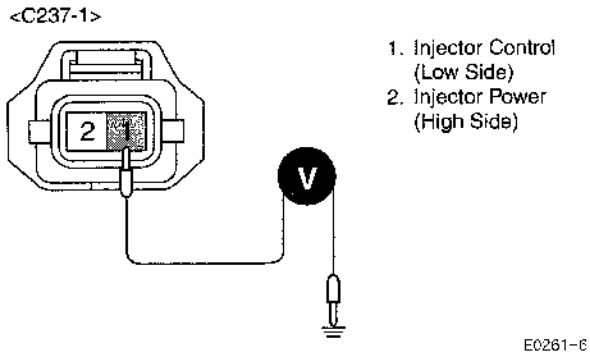
NO

▶ Check for short to battery in the power harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION E8BFE424

1. Ignition "OFF".
2. Disconnect Injector connector.
3. Ignition "ON" and Engine "OFF".
4. Measure voltage between terminal 1 of the injector harness connector and chassis ground

Specification : Approx. below 1V



5. Is the measured voltage within specifications ?

YES

▶ Go to "Component Inspection"procedure.

NO

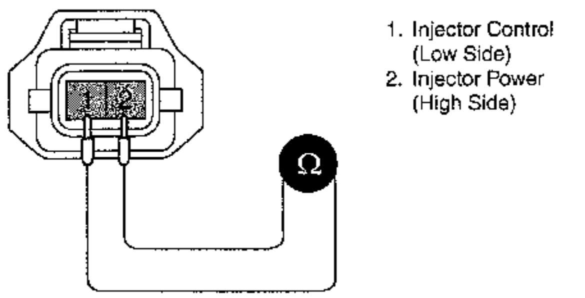
▶ Check for short to battery in harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION ED9151BA

1. Ignition "OFF"
2. Disconnect Injector connector.
3. Measure resistance between terminal 1 and 2 of injector connector (Component side).

Specification : 0.365Ω ± 0.055(20°C)

<C237-1>



E0261-7

4. Is the measured resistance within specifications ?

YES

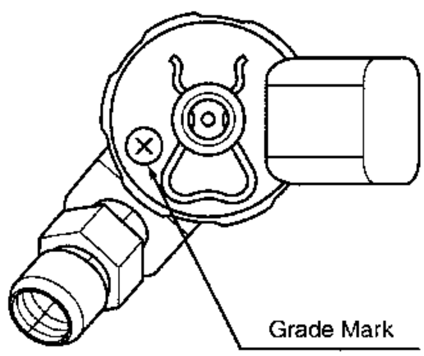
▶ Substitute with a known-good ECM and check for proper operation.
If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure."

NO

▶ Check injector for deterioration, or damage.
Substitute with a known-good injector and check for proper operation.
If the problem is corrected, replace injector and then go to "Verification of Vehicle Repair" procedure.

NOTE

Before replacing injector, be sure that grade mark(X,Y,Z) should be satisfied with combination as below.



Grade	X	Y	Z	Remark
1	0	4	0	Satisfy with the number of Grades
2	1	3	0	
3	0	3	1	
4	2	2	0	
5	0	2	2	

E0261-8

VERIFICATION OF VEHICLE REPAIR EF25FF3A

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle within DTC Enable conditions in General information.
3. Are any DTCs present ?

YES

Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

DTC P0262 | CYLINDER1-INJECTOR CIRCUIT HIGH

COMPONENT LOCATION E435C6CC

Refer to DTC P0261.

DESCRIPTION EA3BACC5

GENERAL DESCRIPTION

Refer to DTC P0261.

DTC DESCRIPTION

If the signal exceeds threshold value, the ECM judged this as a fault and DTC is set.

DTC DETECTING CONDITION E4E9BA58

Item	Detecting Condition	Possible Cause
DTC Strategy	• Circuit continuity check	• Short to battery in power circuit • Faulty injector • Faulty ECM
Enable Conditions	• Engine run	
Threshold Value	• Overcurrent high side connection : Injector current increases the maximum value of 28 A~36 A	
Diagnostic Time	• 0.3 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• Yes • Yes • No • No	

SPECIFICATION EBC0C860

	Injector
Resistance	0.365 ± 0.055 Ω at 20°C

SCHEMATIC DIAGRAM EE4186E5

Refer to DTC P0261.

SIGNAL WAVEFORM EF11847B

Refer to DTC P0261.

MONITOR SCANTOOL DATA ED8DE1E9

Refer to DTC P0261.

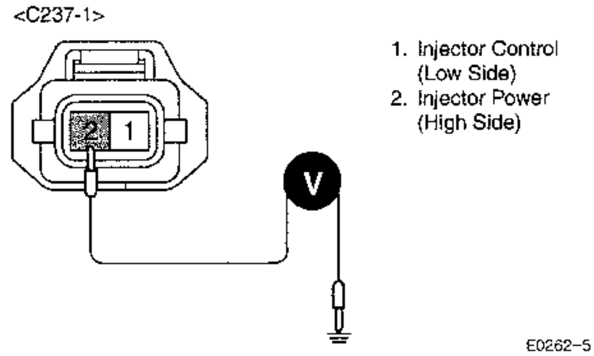
TERMINAL & CONNECTOR INSPECTION E01F08F7

Refer to DTC P0261.

POWER CIRCUIT INSPECTION E5BFD69B

1. Ignition "OFF".
2. Disconnect injector connector.
3. Ignition "ON" & Engine "ON".
4. Measure voltage between terminal 2 of the #1 injector and chassis ground.

Specification : B+



5. Is the measured voltage within specifications ?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Check for short to battery in the power harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E1B6BC9B

Refer to DTC P0261.

VERIFICATION OF VEHICLE REPAIR EC63C10D

Refer to DTC P0261.

DTC P0263 | CYL-1 INJECTOR CIRCUIT BALANCE (LOAD DROP IS DETECTED)

COMPONENT LOCATION E8967F0D

Refer to DTC P0261.

DESCRIPTION E30726AF

GENERAL DESCRIPTION

Refer to DTC P0261.

DTC DESCRIPTION

If the signal is below threshold value, the ECM judged this as a fault and DTC is set.

DTC DETECTING CONDITION EF0C9CB0

Item	Detecting Condition	Possible Cause
DTC Strategy	• Circuit continuity check	• Open in power circuit • Short to ground in control circuit • Open in control circuit • Faulty injector • Faulty ECM
Enable Conditions	• Engine run	
Threshold Value	• Load drop error : load drop is detected if during energizing the minimum current/min = 3A is not reached • Fast current decrease error : a fixed time after the energizing period the current has to decrease below/min = 3A	
Diagnostic Time	• 0.3 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• Yes • Yes • No • No	

SPECIFICATION E6E8EA36

Injector	
Resistance	0.365 ± 0.055 Ω at 20°C

SCHEMATIC DIAGRAM EAA218CD

Refer to DTC P0261.

SIGNAL WAVEFORM EDB2D640

Refer to DTC P0261.

MONITOR SCANTOOL DATA E2AF3C4A

Refer to DTC P0261.

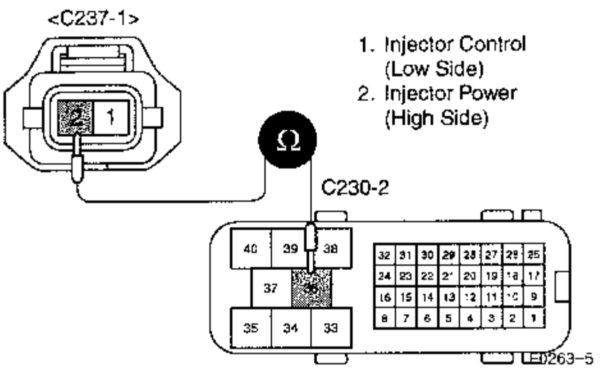
TERMINAL & CONNECTOR INSPECTION E56D41D4

Refer to DTC P0261.

POWER CIRCUIT INSPECTION E98AE9D3

1. Ignition "OFF".
2. Disconnect injector and ECM connector.
3. Measure resistance between terminal 2 of injector harness connector and terminal 36 of ECM harness connector.

Specification : Approx. below 1Ω



4. Is the measured resistance within specifications ?

YES

▶ Go to "Control Circuit Inspection" procedure.

NO

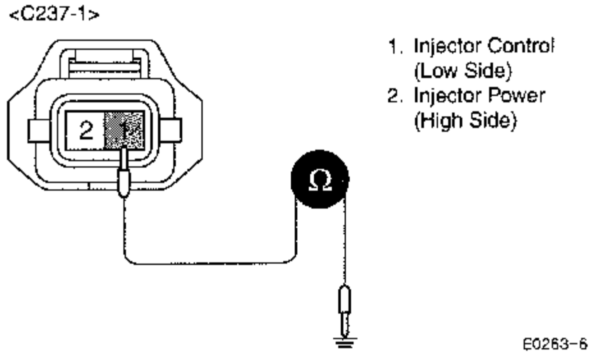
▶ Check for open in the power harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION E4AA36DE

1. Check for short to ground in harness
   1) Ignition "OFF".
   2) Disconnect injector connector.
   3) Ignition "ON" & Engine "OFF"

4) Measure resistance between terminal 1 of injector harness connector and chassis ground

Specification : Infinite



5) Is the measured resistance within specifications ?

YES

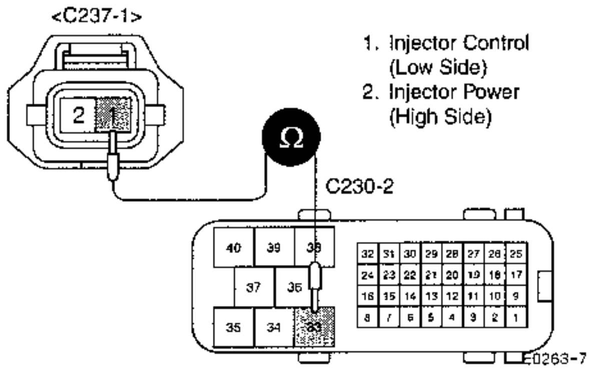
▶ Go to "Check for open in harness" as below.

NO

▶ Check for short to ground in the control harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for open in harness
   1) Ignition "OFF"
   2) Disconnect injector and ECM connector.
   3) Measure resistance between terminal 1 of injector harness connector and terminal 33 of ECM arness connector

Specification : Approx. below 1Ω



4) Is the measured resistance within specifications ?

YES

▶ Go to " Component Inspection " procedure.

NO

▶ Check for open in the control harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E0F79CEF

Refer to DTC P0261.

VERIFICATION OF VEHICLE REPAIR EEEB8A8C

Refer to DTC P0261.

DTC P0264 | CYLINDER2-INJECTOR CIRCUIT LOW

COMPONENT LOCATION EAAD188C

Refer to DTC P0261.

DESCRIPTION E61D7DFF

GENERAL DESCRIPTION

Refer to DTC P0261.

DTC DESCRIPTION

If the signal exceeds threshold value, the ECM judged this as a fault and DTC is set.

DTC DETECTING CONDITION EB0343F9

Item	Detecting Condition	Possible Cause
DTC Strategy	• Circuit continuity check	• Short to battery in power circuit • ,Short to battery in control circuit • Faulty injector • Faulty ECM
Enable Conditions	• Engine run	
Threshold Value	• Overcurrent low side connection : injector current increases the maximum value of 29.5 A ~ 34 A	
Diagnostic Time	• 0.3 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• Yes • Yes • No • No	

SPECIFICATION E5D05AAB

Injector	
Resistance	0.365 ± 0.055 Ω at 20°C

SCHEMATIC DIAGRAM EF83F9AA

Refer to DTC P0261.

SIGNAL WAVEFORM ECF4C615

Refer to DTC P0261.

MONITOR SCANTOOL DATA EAFAAC2D

Refer to DTC P0261.

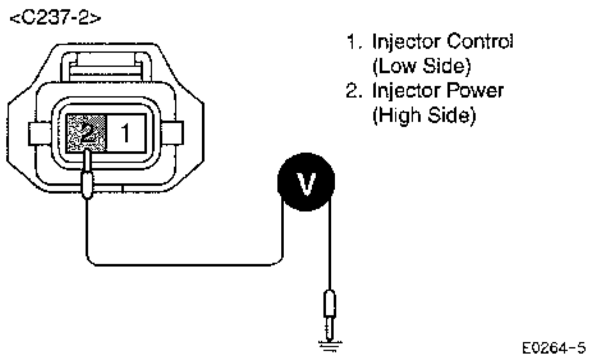
TERMINAL & CONNECTOR INSPECTION E33EB1B9

Refer to DTC P0261.

POWER CIRCUIT INSPECTION E199BF31

1. Ignition "OFF".
2. Disconnect injector connector.
3. Ignition "ON" & Engine "OFF"
4. Measure voltage between terminal 2 of the injector harness connector and chassis ground.

Specification : B+



5. Is the measured voltage within specifications ?

YES

▶ Go to "Control Circuit Inspection" procedure.

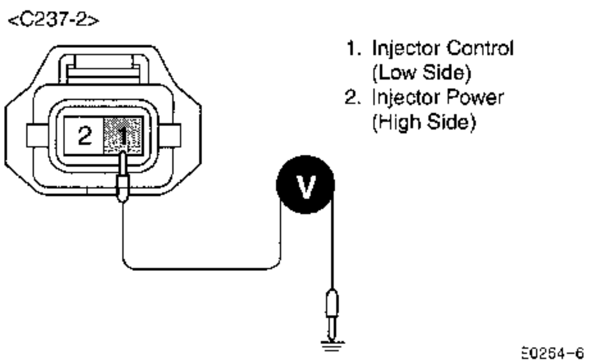
NO

▶ Check for open in the power harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION E60F8DC6

1. Ignition "OFF"
2. Disconnect Injector connector
3. Ignition "ON" and Engine "OFF"
4. Measure voltage between terminal 1 of the injector harness connector and chassis ground

Specification : Approx. below 1V



5. Is the measured voltage within specifications ?

YES

▶ Go to "Component Inspection"procedure

NO

▶ Check for short to battery in harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E869ECCC

Refer to DTC P0261.

VERIFICATION OF VEHICLE REPAIR EDCCDA5A

Refer to DTC P0261.

DTC P0265 | CYLINDER2-INJECTOR CIRCUIT HIGH

COMPONENT LOCATION E0ECF85F

Refer to DTC P0261.

DESCRIPTION E587CD6C

GENERAL DESCRIPTION

Refer to DTC P0261.

DTC DESCRIPTION

If the signal exceeds threshold value, the ECM judged this as a fault and DTC is set.

DTC DETECTING CONDITION EAE4B374

Item	Detecting Condition	Possible Cause
DTC Strategy	• Circuit continuity check	• Short to battery in power circuit • Faulty injector • Faulty ECM
Enable Conditions	• Engine run	
Threshold Value	• Overcurrent high side connection : injector current increases the maximum value of 28 A ~ 36 A	
Diagnostic Time	• 0.3 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• Yes • Yes • No • No	

SPECIFICATION EC21BAEE

	Injector
Resistance	0.365 ± 0.055 Ω at 20°C

SCHEMATIC DIAGRAM EB8BCEFF

Refer to DTC P0261.

SIGNAL WAVEFORM EEF2F694

Refer to DTC P0261.

MONITOR SCANTOOL DATA EB3CFEE8

Refer to DTC P0261.

TERMINAL & CONNECTOR INSPECTION E0A7EC8C

1. Many malfunctions in the electrical system are caused by poor harness and terminals.
   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

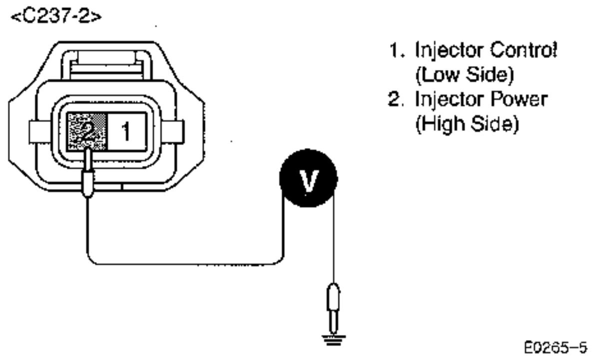
NO

Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION ECC1A1FC

1. Ignition "OFF".
2. Disconnect injector connector.
3. Ignition "ON" & Engine "ON"
4. Measure voltage between terminal 2 of the injector harness connector and chassis ground.

Specification : B+



5. Is the measured voltage within specifications ?

YES

▶ Go to " Component Inspection " procedure.

NO

▶ Check for short to battery in the power harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EF41E99F

Refer to DTC P0261.

VERIFICATION OF VEHICLE REPAIR E5CFCD09

Refer to DTC P0261.

DTC P0266 | CYL-2 INJECTOR CIRCUIT BALANCE (LOAD DROP IS DETECTED)

COMPONENT LOCATION EF8DD4A2

Refer to DTC P0261.

DESCRIPTION E21F81A1

GENERAL DESCRIPTION

Refer to DTC P0261.

DTC DESCRIPTION

If the signal is below threshold value, the ECM judged this as a fault and DTC is set.

DTC DETECTING CONDITION E7BF39B5

Item	Detecting Condition	Possible Cause
DTC Strategy	• Circuit continuity check	• Open in power circuit • Short to ground in control circuit • Open in control circuit circuit • Faulty injector • Faulty ECM
Enable Conditions	• Engine run	
Threshold Value	• Load drop error : load drop is detected if during energizing the minimum current/min = 3A is not reached • Fast current decrease error : a fixed time after the energizing period the current has to decrease below/min = 3A	
Diagnostic Time	• 0.3 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• Yes • Yes • No • No	

SPECIFICATION E3B70EBD

Injector	
Resistance	0.365 ± 0.055 Ω at 20°C

SCHEMATIC DIAGRAM EAAAFC32

Refer to DTC P0261.

SIGNAL WAVEFORM ECBC2A41

Refer to DTC P0261.

MONITOR SCANTOOL DATA EF4DEFC6

Refer to DTC P0261.

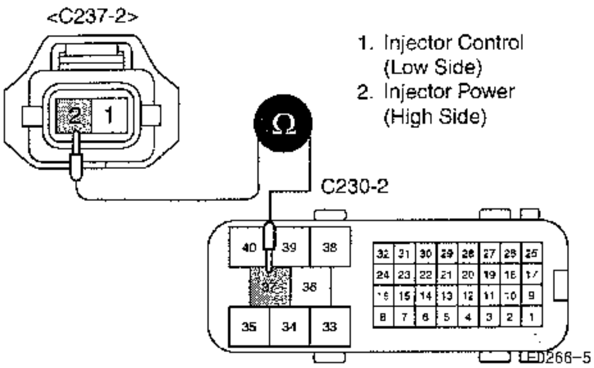
TERMINAL & CONNECTOR INSPECTION ED3246DE

Refer to DTC P0261.

POWER CIRCUIT INSPECTION E9E96CDA

1. Ignition "OFF".
2. Disconnect injector and ECM connector.
3. Measure resistance between terminal 2 of injector harness connector and terminal 37 of ECM harness connector.

Specification : Approx. below 1Ω



4. Is the measured resistance within specifications ?

YES

▶ Go to "Control Circuit Inspection" procedure.

NO

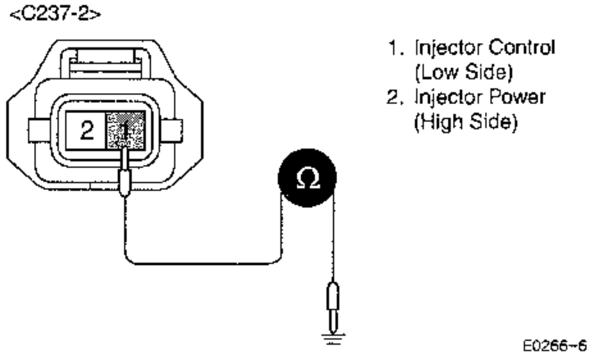
▶ Check for open in the power harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION EBA291DF

1. Check for short to ground in harness
   1) Ignition "OFF".
   2) Disconnect injector connector.
   3) Ignition "ON" & Engine "OFF"

4) Measure resistance between terminal 1 of injector harness connector and chassis ground

Specification : Infinite



5) Is the measured resistance within specifications ?

YES

▶ Go to "Check for open in harness" as below

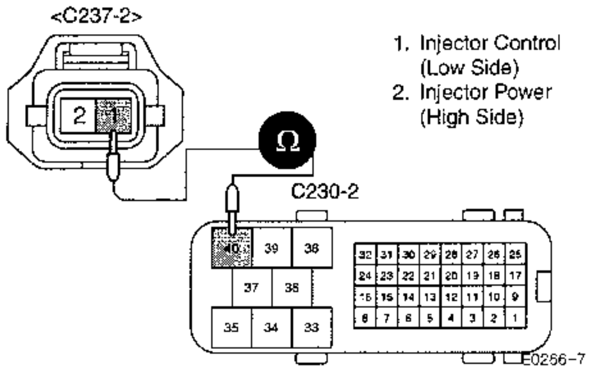
NO

▶ Check for short to ground in the control harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for open in harness

1) Ignition "OFF".
2) Disconnect injector and ECM connector.
3) Measure resistance between terminal 1 of injector harness connector and terminal 40 of ECM harness connector.

Specification : Approx. below 1Ω



4) Is the measured resistance within specifications ?

YES

▶ Go to "Component Inspection" procedure

NO

▶ Check for open in the control harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure .

COMPONENT INSPECTION EEB3497C

Refer to DTC P0261.

VERIFICATION OF VEHICLE REPAIR E4AA1674

Refer to DTC P0261.

DTC P0267 | CYLINDER3-INJECTOR CIRCUIT LOW

COMPONENT LOCATION EA94ACFA

Refer to DTC P0261.

DESCRIPTION E5283A9F

GENERAL DESCRIPTION

Refer to DTC P0261.

DTC DESCRIPTION

If the signal above threshold value, the ECM judged this as a fault and DTC is set.

DTC DETECTING CONDITION E0388FF4

Item	Detecting Condition	Possible Cause
DTC Strategy	• Circuit continuity check	• Short to battery in power circuit • Short to battery in control circuit • Faulty injector • Faulty ECM
Enable Conditions	• Engine run	
Threshold Value	• Overcurrent low side connection : injector current increases the maximum value of 29.5 A ~ 34 A	
Diagnostic Time	• 3 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• Yes • Yes • No • No	

SPECIFICATION E2F8EEAB

Injector	
Resistance	0.365 ± 0.055 Ω at 20°C

SCHEMATIC DIAGRAM EFEB6C18

Refer to DTC P0261.

SIGNAL WAVEFORM E3ADAB16

Refer to DTC P0261.

MONITOR SCANTOOL DATA E81D5F21

Refer to DTC P0261.

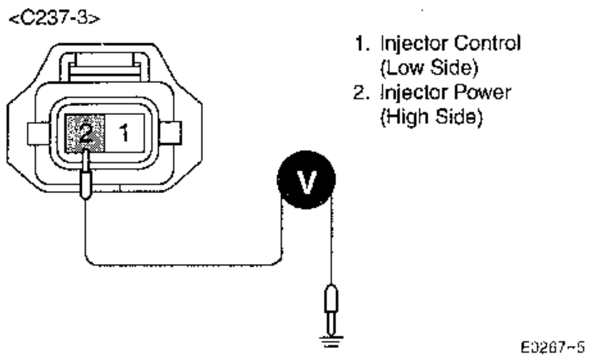
TERMINAL & CONNECTOR INSPECTION EC03B62B

Refer to DTC P0261.

POWER CIRCUIT INSPECTION E7D0CCCD

1. Ignition "OFF".
2. Disconnect injector connector.
3. Ignition "ON" & Engine "OFF"
4. Measure voltage between terminal 2 of the injector harness connector and chassis ground.

Specification : B+



5. Is the measured voltage within specifications ?

YES

▶ Go to "Control Circuit Inspection" procedure.

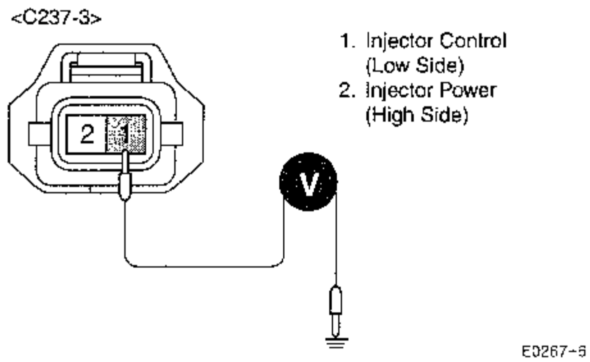
NO

▶ Check for open in the power harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION ED1ACACE

1. Ignition "OFF"
2. Disconnect Injector connector
3. Ignition "ON" and Engine "OFF"
4. Measure voltage between terminal 1 of the injector harness connector and chassis ground

Specification : Approx. below 1V



5. Is the measured voltage within specifications ?

YES

▶ Go to "Component Inspection"procedure.

NO

▶ Check for short to battery in harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EAB1984B

Refer to DTC P0261.

VERIFICATION OF VEHICLE REPAIR EBFBF6D9

Refer to DTC P0261.

DTC P0268 | CYLINDER3-INJECTOR CIRCUIT HIGH

COMPONENT LOCATION E0657C6D

Refer to DTC P0261.

DESCRIPTION E499AA6C

GENERAL DESCRIPTION

Refer to DTC P0261.

DTC DESCRIPTION

If the signal exceeds threshold value, the ECM judged this as a fault and DTC is set.

DTC DETECTING CONDITION E90ADFE9

Item	Detecting Condition	Possible Cause
DTC Strategy	• Circuit continuity check	• Short to battery in power circuit • Faulty injector • Faulty ECM
Enable Conditions	• Engine run	
Threshold Value	• Overcurrent high side connection : injector current increases the maximum value of 28 A ~36 A	
Diagnostic Time	• 0.3 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• Yes • Yes • No • No	

SPECIFICATION E59EB6E0

Injector	
Resistance	0.365 ± 0.055 Ω at 20°C

SCHEMATIC DIAGRAM EECCCC83

Refer to DTC P0261.

SIGNAL WAVEFORM E2EE8BF2

Refer to DTC P0261.

MONITOR SCANTOOL DATA E788BF96

Refer to DTC P0261.

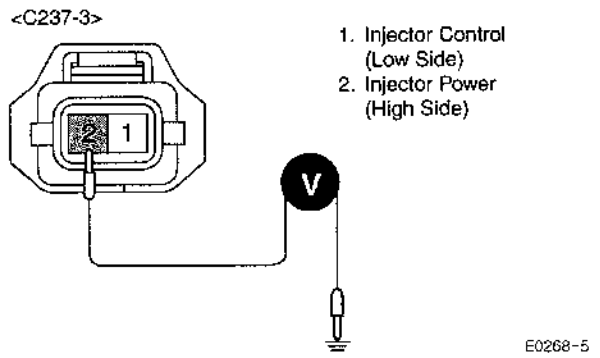
TERMINAL & CONNECTOR INSPECTION ECE5060E

Refer to DTC P0261.

POWER CIRCUIT INSPECTION E05FF3AC

1. Ignition "OFF".
2. Disconnect injector connector.
3. Ignition "ON" & Engine "ON"
4. Measure voltage between terminal 2 of the injector harness connector and chassis ground.

Specification : B+



5. Is the measured voltage within specifications ?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Check for short to battery in the power harness.
Repair as necessary and go to "Verification vehicle Repair" procedure.

COMPONENT INSPECTION EC8B2AB2

Refer to DTC P0261.

VERIFICATION OF VEHICLE REPAIR EFF3E9BE

Refer to DTC P0261.

DTC P0269 | CYL-3 INJECTOR CIRCUIT BALANCE (LOAD DROP IS DETECTED)

COMPONENT LOCATION E5F0CDB8

Refer to DTC P0261.

DESCRIPTION E8C7DC3A

GENERAL DESCRIPTION

Refer to DTC P0261.

DTC DESCRIPTION

If the signal is below threshold value, the ECM judged this as a fault and DTC is set.

DTC DETECTING CONDITION EBD18B3A

Item	Detecting Condition	Possible Cause
DTC Strategy	• Circuit continuity check	• Open in power circuit • Short to ground in control circuit • Open in control circuit • Faulty injector • Faulty ECM
Enable Conditions	• Engine run	
Threshold Value	• Load drop error : load drop is detected if during energizing the minimum current/min = 3A is not reached • Fast current decrease error : a fixed time after the energizing period the current has to decrease below/min = 3A	
Diagnostic Time	• 0.3 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• Yes • Yes • No • No	

SPECIFICATION EE7A4FC4

	Injector
Resistance	0.365 ± 0.055 Ω at 20°C

SCHEMATIC DIAGRAM E36F06D5

Refer to DTC P0261.

SIGNAL WAVEFORM EAC2F3D1

Refer to DTC P0261.

MONITOR SCANTOOL DATA E57621E0

Refer to DTC P0261.

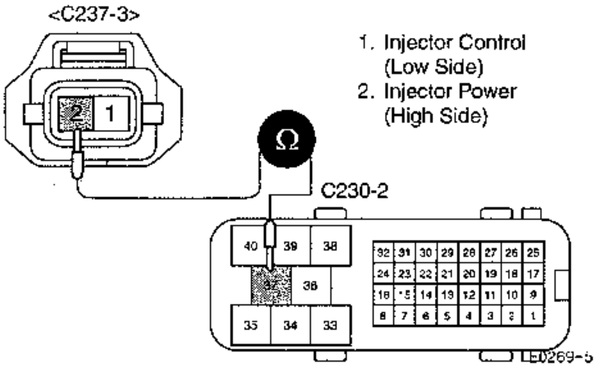
TERMINAL & CONNECTOR INSPECTION E3D7FA0B

Refer to DTC P0261.

POWER CIRCUIT INSPECTION EA5CD8D2

1. Ignition "OFF".
2. Disconnect injector and ECM connector.
3. Measure resistance between terminal 2 of injector harness connector and terminal 37 of ECM harness connector.

Specification : Approx. below 1Ω



4. Is the measured resistance within specifications ?

YES

▶ Go to "Control Circuit Inspection" procedure.

NO

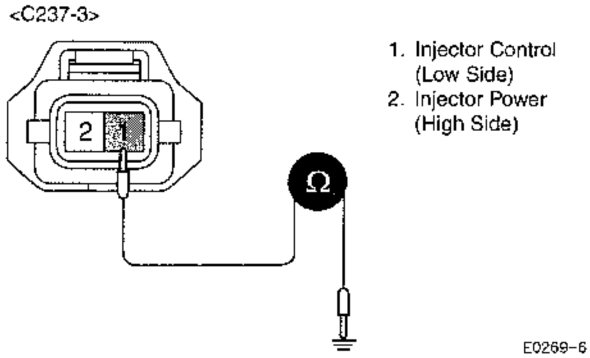
▶ Check for open in the power harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION EBABEE6D

1. Check for short to ground in harness
   1) Ignition "OFF".
   2) Disconnect injector connector.
   3) Ignition "ON" & Engine "OFF".

4) Measure resistance between terminal 1 of injector harness connector and chassis ground.

Specification : Infinite



5) Is the measured resistance within specifications ?

YES

▶ Go to " Check for open in harness" as below.

NO

▶ Check for short to ground in the control harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

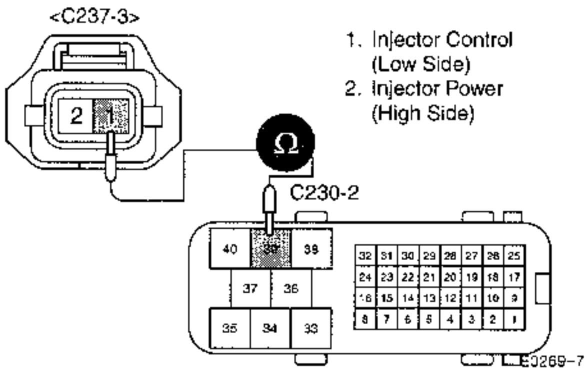
2. Check for open in harness

1) Ignition "OFF".

2) Disconnect injector and ECM connector.

3) Measure resistance between terminal 1 of injector harness connector and terminal 39 of ECM harness connector

Specification : Approx. below 1Ω



4) Is the measured resistance within specifications ?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Check for open in the control harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure

COMPONENT INSPECTION EEBD0C7C

Refer to DTC P0261.

VERIFICATION OF VEHICLE REPAIR EB4D5B79

Refer to DTC P0261.

DTC P0270 | CYLINDER4-INJECTOR CIRCUIT LOW

COMPONENT LOCATION EE32298A

Refer to DTC P0261.

DESCRIPTION E1E94EF3

GENERAL DESCRIPTION

Refer to DTC P0261.

DTC DESCRIPTION

If the signal exceeds threshold value, the ECM judged this as a fault and DTC is set.

DTC DETECTING CONDITION E54AACF5

Item	Detecting Condition	Possible Cause
DTC Strategy	• Circuit continuity check	• Short to battery in power circuit • Short to battery in control circuit • Faulty injector • Faulty ECM
Enable Conditions	• Engine run	
Threshold Value	• Overcurrent low side connection : injector current increases the maximum value of 29.5 A ~ 34 A	
Diagnostic Time	• 0.3 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• Yes • Yes • No • No	

SPECIFICATION ECDAA100

Injector	
Resistance	0.365 ± 0.055 Ω at 20°C

SCHEMATIC DIAGRAM E6AAF9AE

Refer to DTC P0261.

SIGNAL WAVEFORM EC958E1C

Refer to DTC P0261.

MONITOR SCANTOOL DATA E728BC2B

Refer to DTC P0261.

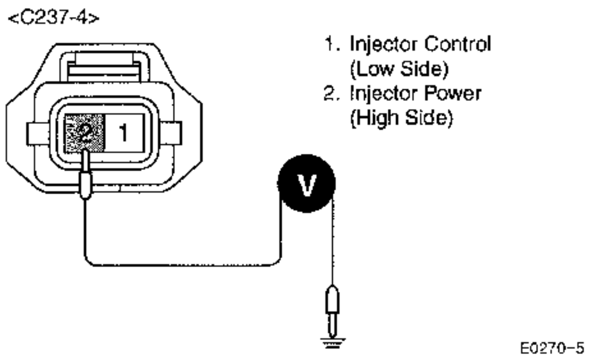
TERMINAL & CONNECTOR INSPECTION E2396BBE

Refer to DTC P0261.

POWER CIRCUIT INSPECTION E82D39C8

1. Ignition "OFF".
2. Disconnect injector connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 2 of the injector harness connector and chassis ground.

Specification : B+



5. Is the measured voltage within specifications ?

YES

▶ Go to "Control Circuit Inspection" procedure.

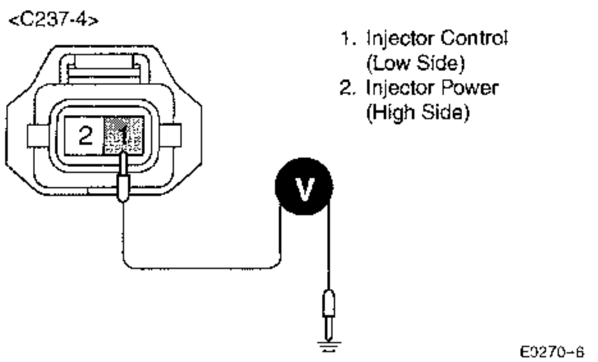
NO

▶ Check for short to battery in the power harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION EBEB5E4A

1. Ignition "OFF".
2. Disconnect Injector connector.
3. Ignition "ON" and Engine "OFF".
4. Measure voltage between terminal 1 of the injector harness connector and chassis ground.

Specification : Approx. below 1V



5. Is the measured voltage within specifications ?

YES

▶ Go to "Component Inspection"procedure.

NO

▶ Check for short to battery in harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EFB454CC

Refer to DTC P0261.

VERIFICATION OF VEHICLE REPAIR EQ4C0158

Refer to DTC P0261.

DTC P0271 | INJECTOR CIRCUIT HIGH INPUT-CYLINDER 4

COMPONENT LOCATION EE04A95D

Refer to DTC P0261.

DESCRIPTION E48F96E1

GENERAL DESCRIPTION

Refer to DTC P0261.

DTC DESCRIPTION

If the signal exceeds threshold value, the ECM judged this as a fault and DTC is set.

DTC DETECTING CONDITION EE1BBCE0

Item	Detecting Condition	Possible Cause
DTC Strategy	• Circuit continuity check	• Short to battery in power circuit • Faulty injector • Faulty ECM
Enable Conditions	• Engine run	
Threshold Value	• Overcurrent high side connection : injector current increases the maximum value of 28 A ~ 36 A	
Diagnostic Time	• 0.3 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• Yes • Yes • No • No	

SPECIFICATION EBB271E5

	Injector
Resistance	0.365 ± 0.055 Ω at 20°C

SCHEMATIC DIAGRAM E9B9CFFD

Refer to DTC P0261.

SIGNAL WAVEFORM E266DE9F

Refer to DTC P0261.

MONITOR SCANTOOL DATA E6909C9E

Refer to DTC P0261.

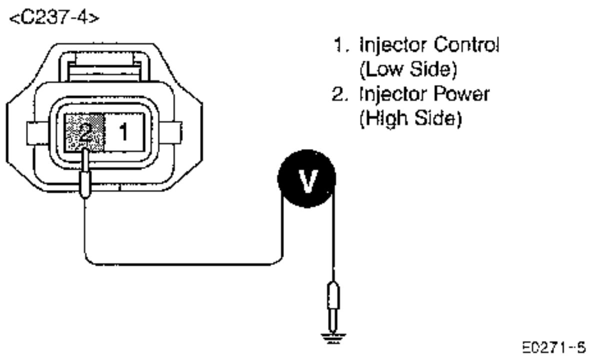
TERMINAL & CONNECTOR INSPECTION E10ACBAB

Refer to DTC P0261.

POWER CIRCUIT INSPECTION E79EA9A3

1. Ignition "OFF".
2. Disconnect injector connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 2 of the injector harness connector and chassis ground.

Specification : B+



5. Is the measured voltage within specifications ?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Check for short to battery in the power harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION ECE1A6BF

Refer to DTC P0261.

VERIFICATION OF VEHICLE REPAIR EFA5C4BF

Refer to DTC P0261.

DTC P0272 | CYL-4 INJECTOR CIRCUIT BALANCE (LOAD DROP IS DETECTED)

COMPONENT LOCATION E142FBC8

Refer to DTC P0261.

DESCRIPTION E0CAD5EB

GENERAL DESCRIPTION

Refer to DTC P0261.

DTC DESCRIPTION

If the signal is below threshold value, the ECM judged this as a fault and DTC is set.

DTC DETECTING CONDITION EDD50FB6

Item	Detecting Condition	Possible Cause
DTC Strategy	• Circuit continuity check	• Open in power circuit • Short to ground in control circuit • Open in control circuit • Faulty injector • Faulty ECM
Enable Conditions	• Engine run	
Threshold Value	• Load drop error : load drop is detected if during energizing the minimum current/min = 3A is not reached • Fast current decrease error : a fixed time after the energizing period the current has to decrease below/min = 3A	
Diagnostic Time	• 3 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• Yes • Yes • No • No	

SPECIFICATION EABFAE6E

	Injector
Resistance	0.365 ± 0.055 Ω at 20°C

SCHEMATIC DIAGRAM EC0FCF97

Refer to DTC P0261.

SIGNAL WAVEFORM E844EB6F

Refer to DTC P0261.

MONITOR SCANTOOL DATA E4F6DC9A

Refer to DTC P0261.

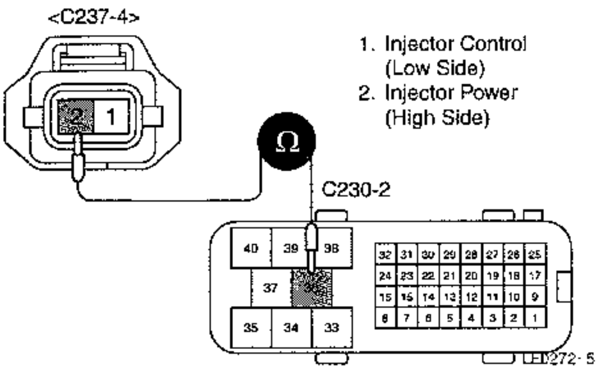
TERMINAL & CONNECTOR INSPECTION E8DE308D

Refer to DTC P0261.

POWER CIRCUIT INSPECTION E595CFE9

1. Ignition "OFF".
2. Disconnect injector and ECM connector.
3. Measure resistance between terminal 2 of injector harness connector and terminal 36 of ECM harness connector.

Specification : Approx. below 1Ω



4. Is the measured resistance within specifications ?

YES

▶ Go to "Control Circuit Inspection" procedure.

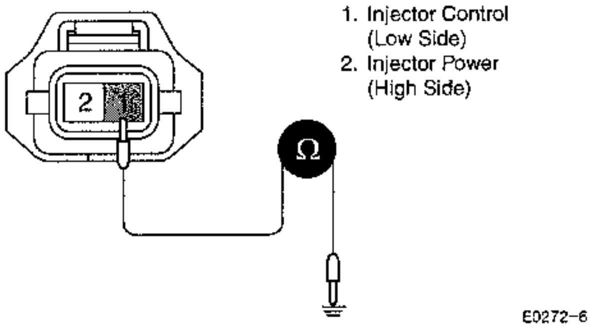
NO

▶ Check for open in the power harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION E9C27D3A

1. Check for short to ground in harness
   1) Ignition "OFF".
   2) Disconnect injector connector.
   3) Ignition "ON" & Engine "OFF".
   4) Measure resistance between terminal 1 of injector harness connector and chassis ground.

Specification : Infinite



   5) Is the measured resistance within specifications ?

   YES

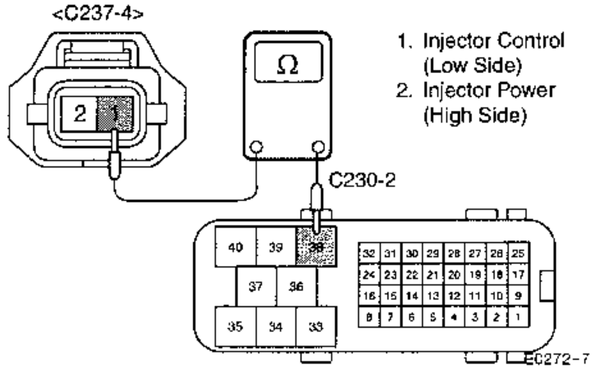
   ▶ Go to "Check for open in harness" as below.

   NO

   ▶ Check for short to ground in the control harness.
   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for open in harness
   1) Ignition "OFF".
   2) Disconnect injector and ECM connector.
   3) Measure resistance between terminal 1 of injector harness connector and terminal 38 of ECM harness connector.

Specification : Approx. below 1Ω



4) Is the measured resistance within specifications ?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Check for open in the control harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E5B4B9EC

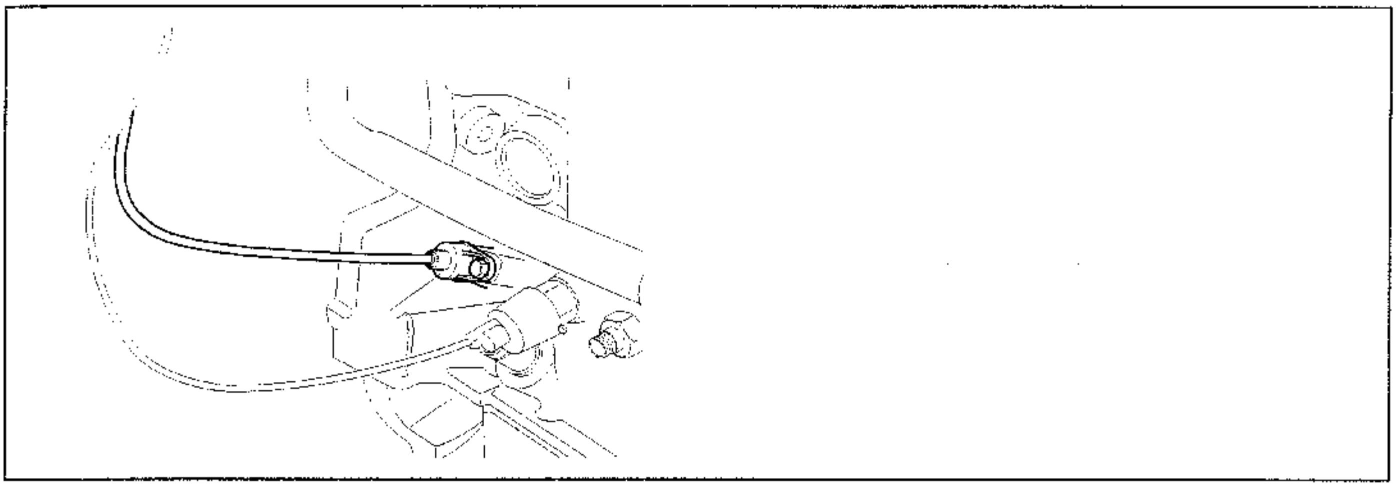
Refer to DTC P0261.

VERIFICATION OF VEHICLE REPAIR EF79DEC8

Refer to DTC P0261.

DTC P0336 | CRANKSHAFT POSITION SENSOR CIRCUIT OUT OF RNAGE

COMPONENT LOCATION E9FF4476



E0336-1

DESCRIPTION E409F1EA

GENERAL DESCRIPTION

The crankshaft angular sensor detects and counts the teeth on the crankshaft and provides ECM with the information on the current position of crank angle and cylinder. This signal is fed to ECM to be used to determine the engine speed and adjust the fuel injection timing. The camshaft position sensor detects the teeth target wheel and provides ECM with the information on the current position of piston and cylinder.

This signal is fed to ECM to be used to determine the sequence of fuel injection.

In case of the the crankshaft angular sensor or the camshaft position sensor failure, the engine symptoms will occur a running engine stall, starting impossible and rough idle with noise.

DTC DESCRIPTION

If the difference between actual CKP value and calculated CKP value is generated, the ECM judged this as a fault and DTC is set.

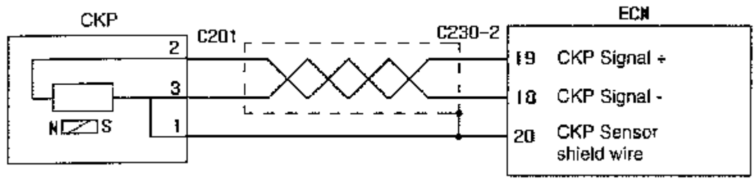
DTC DETECTING CONDITION E66F9988

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal check	• Open or short to signals(+,-) harness • Open in ground harness • Faulty CKP • Faulty CKP tone wheel • Faulty ECM
Enable Conditions	• Engine run	
Threshold Value	• Crank angular with acceleration or deceleration is out of allowed limits (dynamic plausibility)	
Diagnostic Time	• 0.09 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• No • No • Yes • No	

SPECIFICATION EBC376FD

CKP	
Resistance	860 ± 10% Ω at 20°C

SCHEMATIC DIAGRAM E77614FC

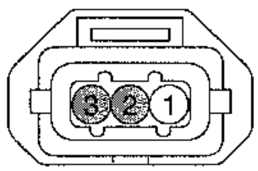


[Connection Information]

1	C230-2 Terminal 20	CKP shield wire
2	C230-2 Terminal 19	CKP sensor signal +
3	C230-2 Terminal 18	CKP sensor signal -

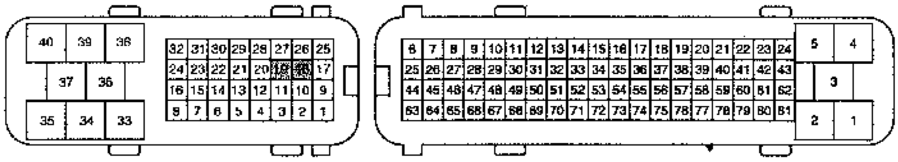
[CONNECTOR]

CKP Harness side connector



CKP (C201)

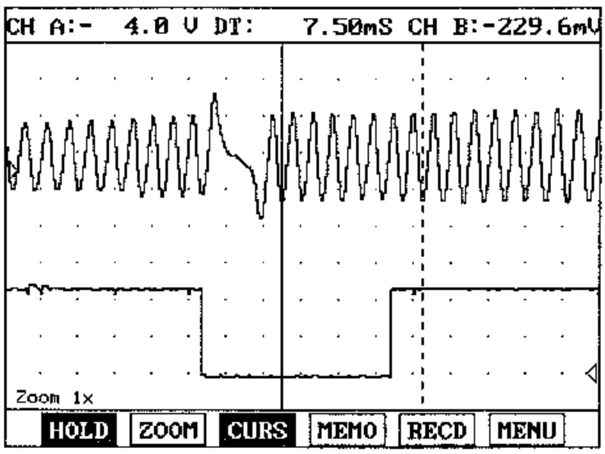
ECM side terminal



C230-2 C230-1

E0336-2

SIGNAL WAVEFORM E2FE610F



The given data is the normal waveform of the crankshaft position sensor (CKPS) and the Camshaft position sensor (CMPS).
The CKP sinusoidal signal generates continuosly except 2 missing teeth.
but the CMP squre waveform signal is output even when the CMP sensor meets the dowel pin of camshaft.
If the waveform pattern becomes distorted or generated no signal while cranking or idling, replace the CKP or the CMP.

E0336-3

MONITOR SCANTOOL DATA EFEC3F19

1. Connect scantool to Data Link Cable (DLC).
2. Warm up engine to normal operating temperature.
3. Monitor "Acceleration Position Sensor & Engine Speed" parameter on the scantool .

FIG 1

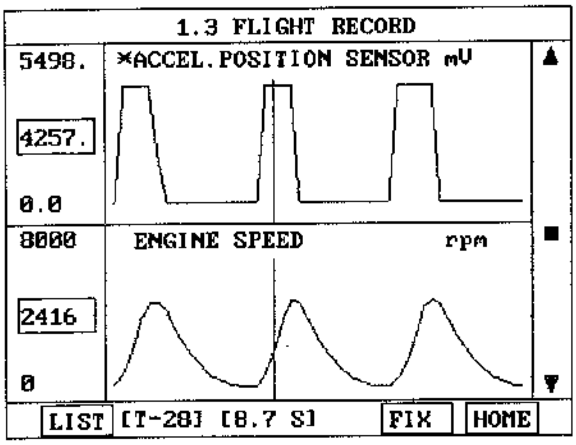


Fig 1) APS signal and engine speed increase when depressing accel pedal.

Is the Current data displayed correctly ?

YES

Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "W/Harness Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION EA2A4712

1. Many malfunctions in the electrical system are caused by poor harness and terminals..

   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

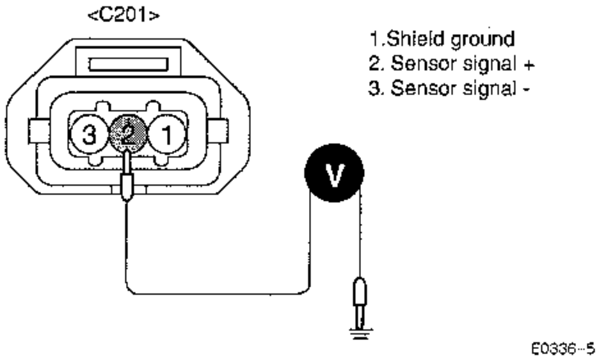
NO

Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION EFFB5C24

1. Check for open or short in signal (+) harness
   1) Ignition "OFF" & Engine "OFF".
   2) Disconnect CKP sensor connector.
   3) Ignition "ON" & Engine "OFF".
   4) Measure voltage between terminal 2 of the sensor harness connector and chassis ground.

   Specification : Approx. 2.5V



   5) Is the measured voltage within specifications ?

   YES

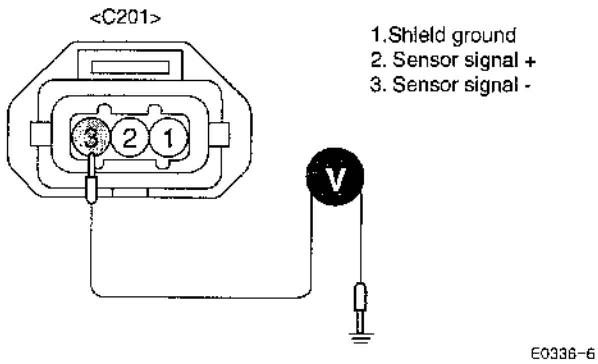
   ▶ Go to "Check for open or short in signal(-) harness" as below.

   NO

   ▶ Check for open or short in signal(+) harness.
   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for open or short in signal (-) harness
   1) Ignition "OFF" & Engine "OFF".
   2) Disconnect CKP sensor connector.
   3) Ignition "ON" & Engine "OFF".
   4) Measure voltage between terminal 3 of the sensor harness connector and chassis ground.

   Specification : Approx. 2.5V



5) Is the measured voltage within specifications ?

YES

▶ Go to "Ground Circuit Inspection" procedure.

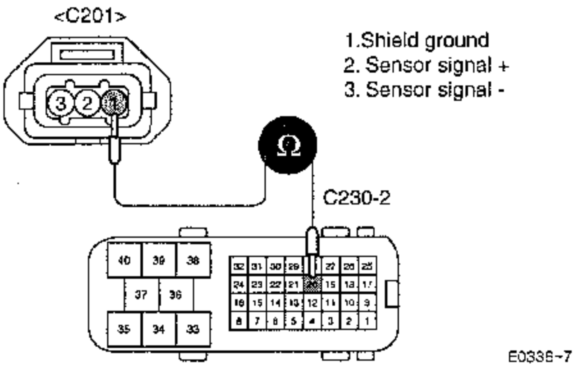
NO

▶ Check for open or short in signal(-) harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION EC9B0AB9

1. Ignition "OFF" & Engine "OFF".
2. Disconnect CKP sensor and ECM connector.
3. Measure resistance between terminal 1 of the sensor harness connector and terminal 20 of ECM harness connector.

Specification : Approx. below 1Ω



4. Is the measured resistance within specifications ?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Check for open in harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EE62AFCD

1. Check tone wheel.
   1) Ignition "OFF" & Engine "OFF".
   2) Remove CKPS.
   3) Visually check that Tone wheel is O.K through the installation hole for CKPS.
   4) Is the Tone wheel installed on the crankshaft O.K ?

YES

▶ Go to "Check CKPS" as below.

NO

▶ Check Tone wheel for contamination, deterioration or damage.
Replace Tone wheel on the crankshaft as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check CKPS
   1) Ignition "OFF".
   2) Remove CKPS and then connect CKPS connector to CKPS.
   3) Ignition "ON" & Engine "OFF".
   4) Move a metal on the detecting edge of CKPS with monitoring signal waveform.
   5) Is the signal waveform displayed ?

   YES

   6) ▶ Substitute with a known-good ECM and check for proper operation. If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.

   NO

   ▶ Substitute with a known-good CMPS and check for proper operation. If the problem is corrected, replace CMPS and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EEA1B7EC

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle within DTC Enable conditions in General information.
3. Are any DTCs present ?

YES

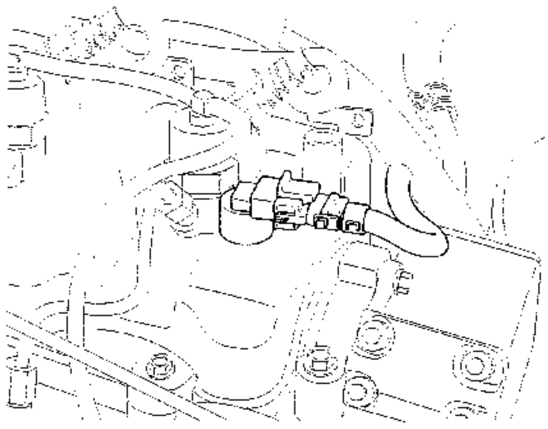
Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

DTC P0341 | CAMSHAFT POSITION SENSOR CIRCUIT RANGE/PERFORMANCE

COMPONENT LOCATION EAC4DDEB



E0341-1

DESCRIPTION E655A2F7

GENERAL DESCRIPTION

The crankshaft angular sensor detects and counts the teeth on the crankshaft and provides ECM with the information on the current position of crank angle and cylinder. This signal is fed to ECM to be used to determine the engine speed and adjust the fuel injection timing. The camshaft position sensor detects the teeth target wheel and provides ECM with the information on the current position of piston and cylinder.

This signal is fed to ECM to be used to determine the sequence of fuel injection.

In case of the the crankshaft angular sensor or the camshaft position sensor failure, the engine symptoms will occur a running engine stall, starting impossible and rough idle with noise.

DTC DESCRIPTION

If the CMP signal is not geneated, the ECM judged this as a fault and DTC is set.

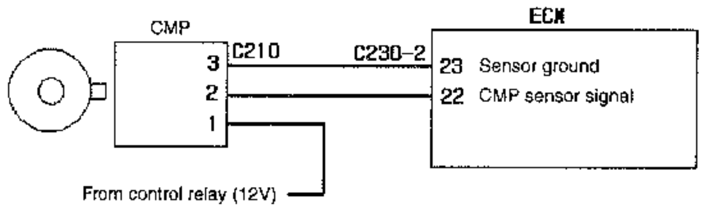
DTC DETECTING CONDITION EB5BEAFF

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal check	• Open or short in power circuit • Open or short in signal circuit • Open in ground circuit • Faulty CMP • Faulty CMP dowel pin • Faulty ECM
Enable Conditions	• Engine run	
Threshold Value	• Cam signal fails at the condition of crank signal generation. (Cam signal static defection)	
Diagnostic Time	• 0.7 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• No • No • Yes • No	

SPECIFICATION E5FFFE91

	CKP
Resistance	860 ± 10% Ω at 20°C

SCHEMATIC DIAGRAM EFBB2D00



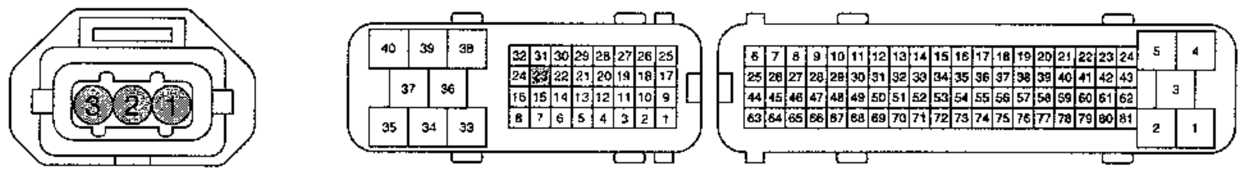
[Connection Information]

1	C223 Terminal 17	Control relay power
2	C230-2 Terminal 22	CMP sensor signal
3	C230-2 Terminal 23	CMP sensor ground

[CONNECTOR]

CMP Harness side connector

ECM side terminal



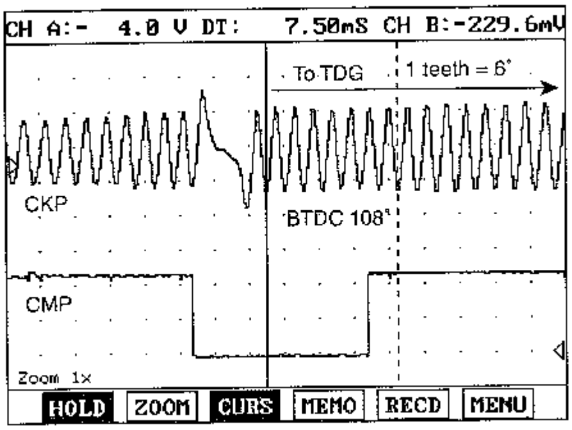
CMP (C210)

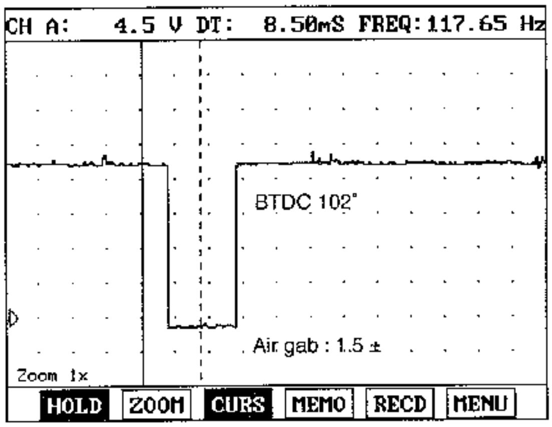
C230-2

C230-1

E0341-2

SIGNAL WAVEFORM ECCB7BA5





The given data is the normal waveform of the crankshaft position sensor (CKPS) and the Camshaft position sensor (CMPS).
The CKP sinusoidal signal generates continuosly except 2 missing teeth.
but the CMP squre waveform signal is output even when the CMP sensor meets the dowel pin of camshaft.
If the waveform pattern becomes distorted or generated no signal while cranking or idling, replace the CKP or the CMP.

EF0341-3

MONITOR SCANTOOL DATA EAB0401D

1. Connect scantool to Data Link Cable (DLC).
2. Warm up engine to normal operating temperature.
3. Monitor "Acceleration Position Sensor & Engine Speed" parameter on the scantool .

FIG 1

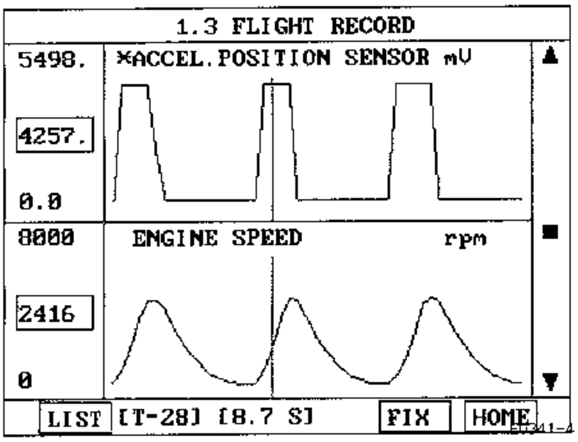


Fig 1) APS signal and engine speed increase when depressing accel pedal.

Is the Current data displayed correctly ?

YES

Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "W/Harness Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION EE0CB7B8

1. Many malfunctions in the electrical system are caused by poor harness and terminals..

   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

   YES

   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

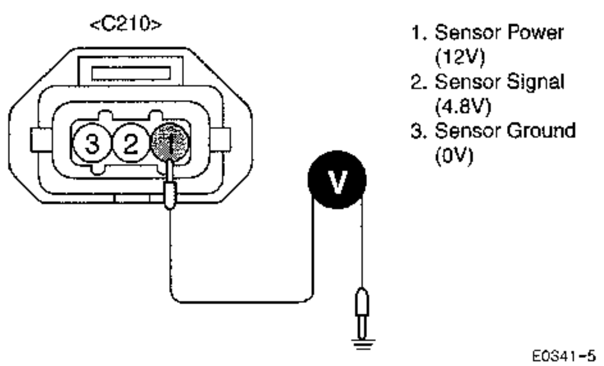
   NO

   Go to "Power Circuit Inspection" procedure.

POWER CIRCUIT INSPECTION E23E65B1

1. Ignition "OFF" & Engine "OFF".
2. Disconnect CMP sensor connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 1 of the sensor harness connector and chassis ground.

Specification : Approx. B+



5. Is the measured voltage within specifications ?

YES

▶ Go to "Signal Circuit Inspection" procedure.

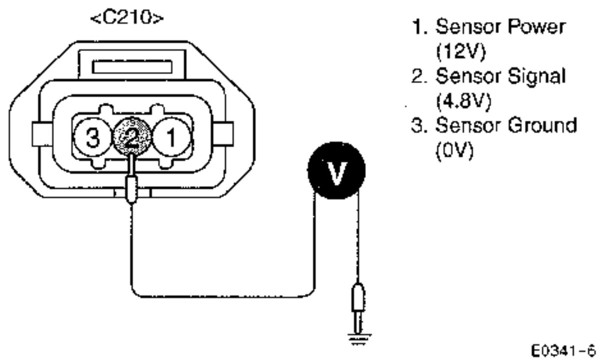
NO

▶ Check for open or short in power harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION E7CFA23D

1. Ignition "OFF" & Engine "OFF".
2. Disconnect CMP sensor connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 2 of the sensor harness connector and chassis ground.

Specification : Approx. 5V



5. Is the measured voltage within specifications ?

YES

▶ Go to "Ground Circuit Inspeciton" procedure.

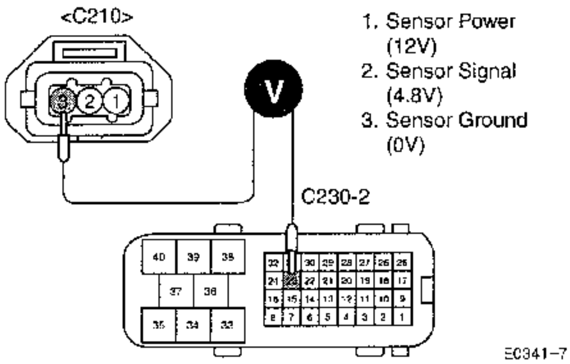
NO

▶ Check for open or short in harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION E3458A46

1. Ignition "OFF" & Engine "OFF".
2. Disconnect CMPS and ECM connector.
3. Measure resistance between terminal 3 of the sensor harness connector and terminal 23 of ECM harness connector.

Specification : Approx. below 1Ω



4. Is the measured resistance within specifications ?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Check for open in harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EDF297CF

1. Check Dowel Pin
   1) Ignition "OFF" & Engine "OFF".
   2) Remove CMPS.
   3) Visually check that Dowel Pin is O.K through the installation hole for CMPS.
   4) Is the Tone wheel installed on the crankshaft O.K ?

   YES

   ▶ Go to "Check CMPS" as below.

   NO

   ▶ Check Dowel Pin on Camshaft for deterioration or damage.
   Replace Camshaft as necessary and go to "Verification of Vehicle Repair" procedure.
2. Check CMPS
   1) Ignition "OFF" & Engine "OFF".
   2) Remove CMPS and then connect CMPS connector to CMPS.
   3) Ignition "ON" & Engine "OFF".
   4) Move a metal on the detecting edge of CMPS with monitoring signal waveform.

5) Is the signal waveform displayed correctly?

YES

▶ Substitute with a known-good ECM and check for proper operation. If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Substitute with a known-good CMPS and check for proper operation. If the problem is corrected, replace CMPS and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E0A6BD5F

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle within DTC Enable conditions in General information.
3. Are any DTCs present ?

YES

Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

DTC P0343 | CAM/ENGINE SPEED SENSOR - HIGH INPUT

COMPONENT LOCATION E52683D3

Refer to DTC P0341.

DESCRIPTION EA2C4AD3

GENERAL DESCRIPTION

Refer to DTC P0341.

DTC DESCRIPTION

If the CMP signal is not geneated, the ECM judged this as a fault and DTC is set.

DTC DETECTING CONDITION E897CE70

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal check	• Short to ground in signal circuit • Faulty CMP • Faulty CMP dowel pin • Faulty ECM
Enable Conditions	• Engine run	
Threshold Value	• If the CAM signal frequency detects too many edges	
Diagnostic Time	• 0 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• No • No • Yes • No	

SPECIFICATION EB217578

CKP	
Resistance	860 ± 10% Ω at 20°C

SCHEMATIC DIAGRAM EEC222F3

Refer to DTC P0341.

SIGNAL WAVEFORM E3CF9A9C

Refer to DTC P0341.

MONITOR SCANTOOL DATA E67D07F7

Refer to DTC P0341.

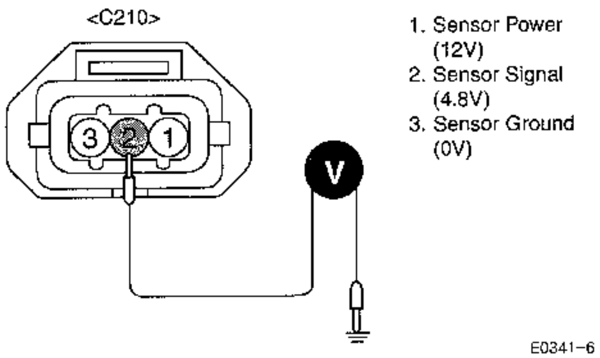
TERMINAL & CONNECTOR INSPECTION E00FC5A6

Refer to DTC P0341.

SIGNAL CIRCUIT INSPECTION ED1A820A

1. Ignition "OFF" & Engine "OFF".
2. Disconnect CMP sensor connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 2 of the sensor harness connector and chassis ground.

Specification : Approx. 5V



5. Is the measured voltage within specifications ?

YES

▶ Go to "Component Inspeciton" procedure.

NO

▶ Check for open or short in harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E217DA11

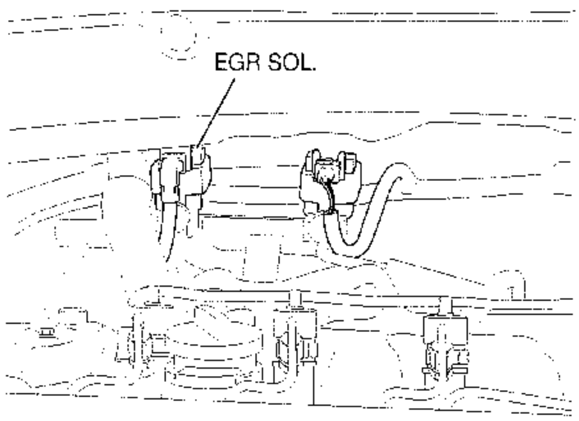
Refer to DTC P0341.

VERIFICATION OF VEHICLE REPAIR EDD4E82C

Refer to DTC P0341.

DTC P0401 | EXHAUST GAS RECIRCULATION FLOW INSUFFICIENT DETECTED

COMPONENT LOCATION E3BDE52E



P0401-1

DESCRIPTION E8B53BCA

GENERAL DESCRIPTION

The EGR (Exhaust Gas Recirculation) system is used to divert some of the exhaust gas to the engine inlet system in order to reduce an excess of air and the temperature in the combustion chamber.

This device also significantly reduces emissions of the nitric oxide at the exhaust.

The EGR system is composed of a solenoid valve, a proportional pneumatic valve and an air flow meter.

The EGR solenoid valve controls the opening and closing the pneumatic valve using the low pressure from the braking assistance circuit. The low pressure is created by the vaccum pump located at the end of the alternator.

The duty control of the solenoid valve is determined by the injection computer depending on the air flow requested.

In case of EGR solenoid valve failure, the engine performance will be reduced.

DTC DESCRIPTION

If the signal exceeds threshold value, the ECM judged this as a fault and DTC is set.

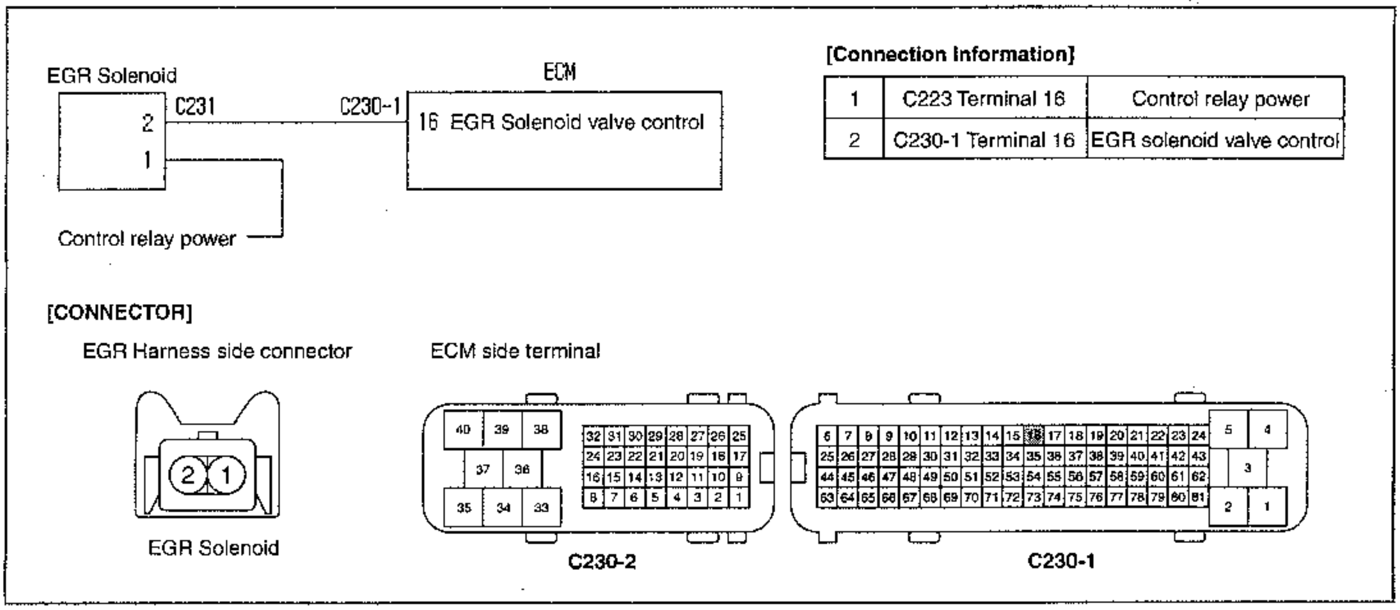
DTC DETECTING CONDITION E09DBAC8

Item	Detecting Condition	Possible Cause
DTC Strategy	• Rationality check	• Fuse blown • Faulty MAFS • Faulty EGR system • Faulty Turbo charger system • Faulty ECM
Enable Conditions	• Engine run	
Threshold Value	• 1400 < Engine speed < 2000 rpm and injection quantity < 0.2 mcc.	
Diagnostic Time	• 6 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• Yes • Yes • No • Yes	

SPECIFICATION E779AE45

EGR	
Resistance	Operating Frequency
14 ~ 17 Ω at 20°C	300 Hz

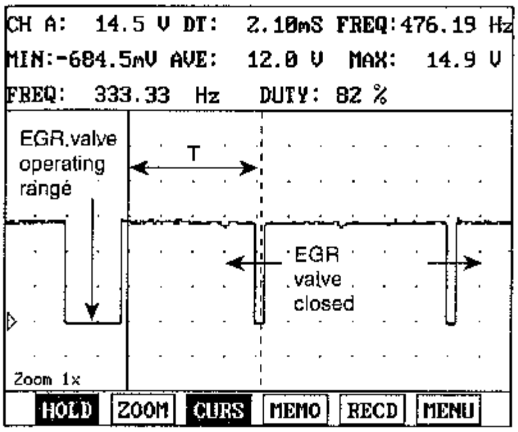
SCHEMATIC DIAGRAM EA93C5D4



1	C223 Terminal 16	Control relay power
2	C230-1 Terminal 16	EGR solenoid valve control

E0401-2

SIGNAL WAVEFORM EDACF258



1.4 ACTUATION TEST

EGR ACTUATOR	
DURATION	UNTIL STOP KEY
METHOD	ACTIVATION
CONDITION	IG.KEY ON ENGINE OFF

PRESS [STRT], IF YOU ARE READY !
SELECT TEST ITEM USING UP/DOWN KEY

STRT STOP

This test should be inspected after depressing the HOLD mode at the operating range of EGR valve.
The time T becomes shorter when the EGR valve is opened increasingly.
For checking the wire from the fuses to the solenoid valve with the ECM circuit, the START key should be pressed in the scan tool actuation test mode.
And then make sure that the the solenoid valve "click" noise could be heard.

E0401-3

MONITOR SCANTOOL DATA EBAAEA6F

1. Connect scantool to Data Link Cable (DLC).
2. Warm up engine to normal operating temperature.
3. Monitor that "Mass Air Flow Sensor" parameter on the scantool is changing without EGR actuator operation or with EGR actuator operation while idling engine speed.

FIG 1

1.2 CURRENT DATA

*	MASS AIR FLOW	468	mg/st
*	ENGINE SPEED	751	rpm
*	EGR ACTUATOR	95.0	%
*	FUEL QUANTITY	9	mcc
	BOOSTER V-OPERAT'G INJ	79.9	V
	MIL(ENGINE CHECK)	OFF	
	GLOW RELAY	OFF	
	FUEL PUMP RELAY	ON	

FIX SCRN FULL PART GRPH HELP

FIG 2

1.2 CURRENT DATA

*	MASS AIR FLOW	311	mg/st
*	EGR ACTUATOR	40.8	%
	ENGINE SPEED	760	rpm
	VEHICLE SPEED SENSOR	0	Km/h
	FUEL PRESSURE	270.7	bar
	FUEL PRESS. REGULATOR	16.2	%
	BAROMETRIC PRESS.SNSR	101	kPa
	CLUTCH SW.(M/T ONLY)	ON	

FIX SCRN FULL PART GRPH HELP

Fig 1) Normal value without EGR actuator : Approx. 450 ~ 550 mg/stroke

Fig 2) Normal value with EGR actuator : Approx. 280 ~ 360 mg/stroke

Is Current data displayed correctly ?

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "System Inspection" procedure.

SYSTEM INSPECTION E55EE8E2

1. Visual Inspect MAFS
   1) Check that installation arrow on MAFS is correctly indiated.
   2) Check that connector of MAFS is contaminated, deteriorated or damaged.
   3) Check that air cleaner is O.K
   4) Check that MAFS cylinder is blocked by foreign material, deformed or comtaminated.

      NOTE

      Foreign material or water in intake air makes Hot film in MAFS damage.
   5) Is the MAFS O.K ?

      YES

      ▶ Go to "Check MAFS" as below.

      NO

      ▶ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.
2. Check MAFS
   1) Ignition "ON" & Engine "ON".
   2) Check damage or air leakage from Intercooler hose.
   3) Check that EGR is off when 90 seconds elasped after accelleration.
   4) Monitor MAFS data when engine idle rpm is approximately 800.

      Specification : 500mg/st ± 50mg/st
   5) Is the MAFS parameter displayed within specifications ?

      YES

      ▶ Go to "Component Inspection" procedure.

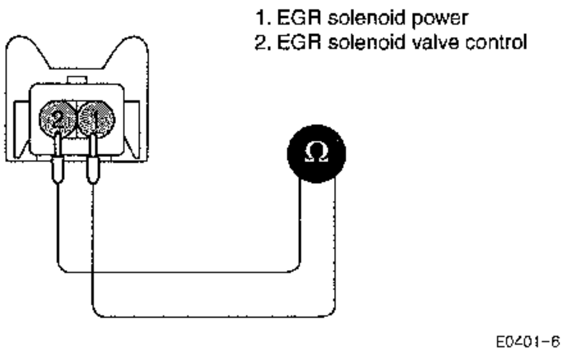
      NO

      ▶ Refer to DTC P0100, P0102, P0103 for more detail inspection.
      Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E3A8FDE4

1. Check for open in EGR solenoid valve
   1) Ignition "OFF".
   2) Disconnect EGR connector.
   3) Measure resistance between terminal 1 and 2 of EGR solenoid valve connector.

Specification : 14 ~ 17 Ω (20°C)



   4) Is the measured resistance within specifications ?

YES

▶ Go to "Check EGR solenoid operation" as below.

NO

▶ Check EGR solenoid for contamination, deterioration, or damage. Substitute with a known-good EGR and check for proper operation. If the problem is corrected, replace EGR and then go to "Verification of Vehicle Repair" procedure.

2. Check EGR solenoid valve operation
   1) Ignition "ON" & Engine "ON".
   2) Confirm that EGR solenoid valve Duty is 5% after warming-up Engine.
   3) Be sure that vacuum is felt after disconnecting vaccum hose from EGR solenoid valve.
   4) Check that vacuum is felt in idle after sudden accelleration(EGR solenoid valve Duty : 95%)

EGR DUTY : 5%	EGR DUTY : 95%
No Vaccum	Vacuum

   5) Is the vaccum felt from vaccum hose according to EGR DUTY ?

YES

▶ Substitute with a known-good ECM and check for proper operation. If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Check EGR solenoid for contamination, deterioration, or damage. Substitute with a known-good EGR and check for proper operation. If the problem is corrected, replace EGR and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E82FCB8F

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle within DTC Enable conditions in General information.
3. Are any DTCs present ?

YES

Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

DTC P0402 | EGR FLOW EXCESSIVE DETECTED

COMPONENT LOCATION E0883AF6

Refer to DTC P0401.

DESCRIPTION EEDBBE9B

GENERAL DESCRIPTION

Refer to DTC P0401.

DTC DESCRIPTION

If the signal exceeds threshold value, the ECM judged this as a fault and DTC is set.

DTC DETECTING CONDITION E1FD550B

Item	Detecting Condition	Possible Cause
DTC Strategy	• Rationality check	• Fuse blown • Faulty MAFS • Faulty EGR system • Faulty Turbo charger system • Faulty ECM
Enable Conditions	• Engine run	
Threshold Value	• 1400 < Engine speed < 2000 rpm and injection quantity < 0.2 mcc.	
Diagnostic Time	• 6 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• Yes • Yes • No • Yes	

SPECIFICATION E6A6ABAE

EGR	
Resistance	Operating Frequency
14 ~ 17 Ω at 20°C	300 Hz

SCHEMATIC DIAGRAM EBF470B7

Refer to DTC P0401.

SIGNAL WAVEFORM ED409EB0

Refer to DTC P0401.

MONITOR SCANTOOL DATA EA7425B9

Refer to DTC P0401.

SYSTEM INSPECTION E5EC7334

Refer to DTC P0401.

COMPONENT INSPECTION EA7B4A4C

Refer to DTC P0401.

VERIFICATION OF VEHICLE REPAIR E8D6BEC1

Refer to DTC P0401.

DTC P0405 | EGR SOLENOID VALVE CIRCUIT - OPEN OR SHORT CIRCUIT

COMPONENT LOCATION EBE96D59

Refer to DTC P0401.

DESCRIPTION EE9A1BDC

GENERAL DESCRIPTION

Refer to DTC P0401.

DTC DESCRIPTION

If the signal exceeds threshold value, the ECM judged this as a fault and DTC is set.

DTC DETECTING CONDITION E7DF9242

Item	Detecting Condition	Possible Cause
DTC Strategy	• Circuit continuity check	• Contact resistance in connectors • Open or short in power circuit • Open in relay control circuit • Fuse blown • Faulty EGR actuator • Faulty ECM
Enable Conditions	• Engine run	
Threshold Value	• Open or short for EGR actuator control circuit	
Diagnostic Time	• 0.48 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• Yes • No • No • Yes	

SCHEMATIC DIAGRAM E00D10D5

Refer to DTC P0401.

SIGNAL WAVEFORM E43F48D4

Refer to DTC P0401.

MONITOR SCANTOOL DATA E9CF9569

Refer to DTC P0401.

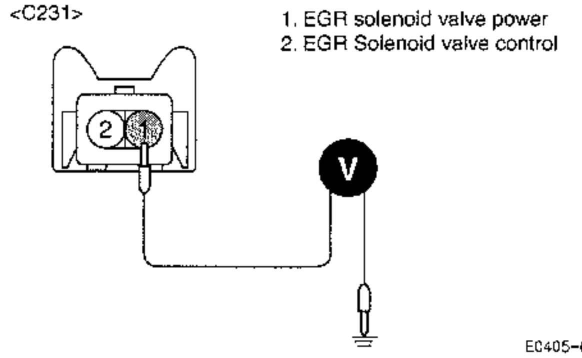
TERMINAL AND CONNECTOR INSPECTION E5466B7F

Refer to DTC P0401.

POWER CIRCUIT INSPECTION EBBADA85

1. Ignition "OFF" & Engine "OFF".
2. Disconnect EGR solenoid valve connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 1 of the EGR solenoid valve harness connector and chassis ground

Specification : Approx. B+



E0405-6

5. Is the measured voltage within specifications ?

YES

▶ Go to " Control Circuit Inspection " procedure.

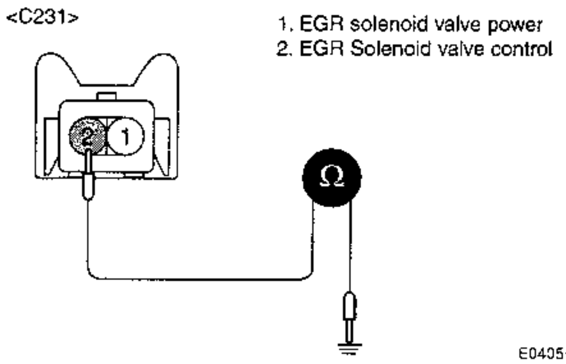
NO

▶ Check for open or short in power harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION EDCC8E84

1. Check for short to ground in control harness
   1) Ignition "OFF" & Engine "OFF".
   2) Disconnect EGR solenoid valve connector.
   3) Measure resistance between terminal 2 of the EGR solenoid valve harness connector and chassis ground.

   Specification : Infinite



E0405-7

4) Is the measured resistance within specifications ?

YES

▶ Go to "Check for open in harness" as below.

NO

▶ Check for short to ground in harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

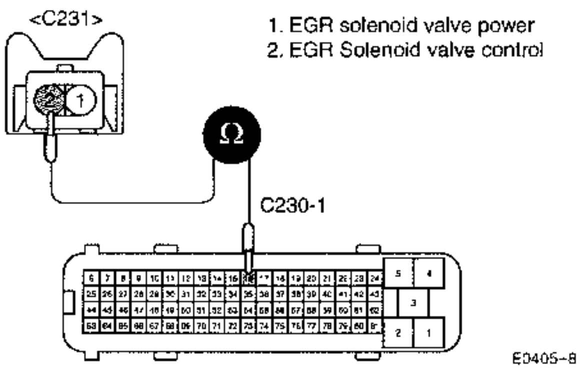
2. Check for open in control harness

1) Ignition "OFF" & Engine "OFF".

2) Disconnected EGR solenoid valve and ECM connector.

3) Measure resistance between terminal 2 of the EGR solenoid valve harness connector and terminal 16 of ECM harness connector.

Specification : Approx. below 1Ω



4) Is the measured resistance within specifications ?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Check for open in harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EB5C3DFF

Refer to DTC P0401.

VERIFICATION OF VEHICLE REPAIR EC2CBCF6

Refer to DTC P0401.

DTC P0406 | EGR SOLENOID VALVE CIRCUIT - SHORT CIRCUIT

COMPONENT LOCATION E0981A0B

Refer to DTC P0401.

DESCRIPTION EC22D8AB

GENERAL DESCRIPTION

The EGR (Exhaust Gas Recirculation) system is used to divert some of the exhaust gas to the engine inlet system in order to reduce an excess of air and the temperature in the combustion chamber.

This device also significantly reduces emissions of the nitric oxides at the exhaust.

The EGR system is composed of a solenoid valve, a proportional pneumatic valve and an air flow meter.

The EGR solenoid valve controls the opening and closing the pneumatic valve using the low pressure from the braking assistance circuit. The low pressure is created by the vaccum pump located at the end of the alternator.

The duty control of the solenoid valve is determined by the injection computer depending on the air flow requested.

In case of EGR solenoid valve failure, the engine performance will be reduced.

DTC DESCRIPTION

If the EGR control circuit is generated threshold value, the ECM judged this as a fault and DTC is set.

DTC DETECTING CONDITION EFC2051E

Item	Detecting Condition	Possible Cause
DTC Strategy	• Circuit continuity check	• Short in power circuit • Short to battery in relay control circuit • Fuse blown • Faulty EGR actuator • Faulty ECM
Enable Conditions	• Engine run	
Threshold Value	• Short for EGR actuator control circuit	
Diagnostic Time	• 0.48 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• Yes • No • No • Yes	

SCHEMATIC DIAGRAM E8CFE227

Refer to DTC P0401.

SIGNAL WAVEFORM E97DF0B0

Refer to DTC P0401.

MONITOR SCANTOOL DATA E7C79EC2

Refer to DTC P0401.

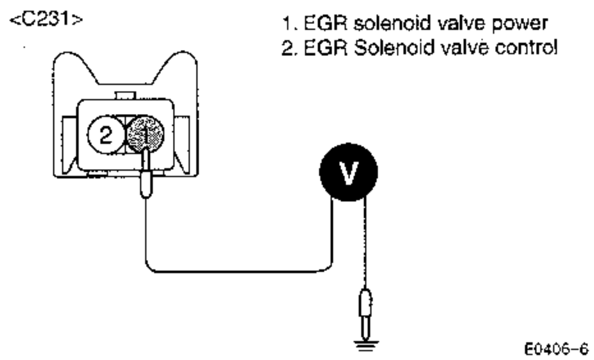
TERMINAL AND CONNECTOR INSPECTION E25E4D47

Refer to DTC P0401.

POWER CIRCUIT INSPECTION E417CBCC

1. Ignition "OFF" & Engine "OFF".
2. Disconnect EGR solenoid valve connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 1 of the EGR solenoid valve harness connector and chassis ground

Specification : Approx. B+



5. Is the measured voltage within specifications ?

YES

▶ Go to " Control Circuit Inspection " procedure.

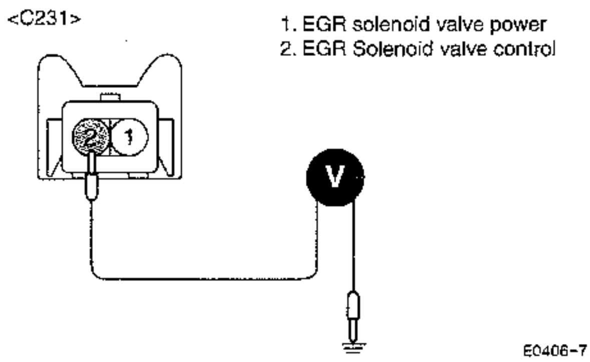
NO

▶ Check for open or short in power harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION EAF82A51

1. Ignition "OFF" & Engine "OFF".
2. Disconnect EGR solenoid valve connector.
3. Measure voltage between terminal 2 of EGR solenoid valve harness connector and chassis ground.

Specification : Approx. below 1V



4. Is the measured voltage within specifications ?

YES

▶ Go to " Component Inspection" procedure

NO

▶ Check for short to battery in harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E5BDDE50

Refer to DTC P0401.

VERIFICATION OF VEHICLE REPAIR E0B5ADDC

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle within DTC Enable conditions in General information.
3. Are any DTCs present ?

YES

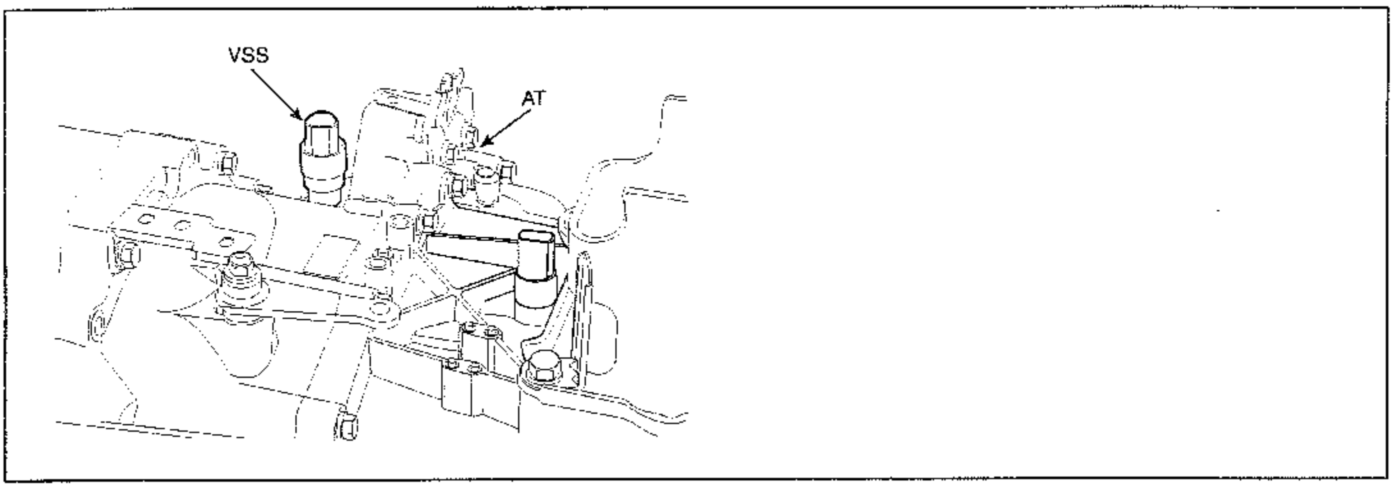
Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

DTC P0501 | VEHICLE SPEED SENSOR RANGE/PERFORMANCE

COMPONENT LOCATION EDB3E2E5



E0501-1

DESCRIPTION EF70FAEF

GENERAL DESCRIPTION

The VSS (Vehicle Speed Sensor) is a hall sensor type. The vehicle speed sensor is buit into the speedometer and converts the transaxle gear revolutions into the pulse signals, which are sent to ECM.

This pulse signal is fed to ECM to be used to determine the vehicle driving or stop condition including the vehicle speed.

The vehicle speed sensor provides ECM with information on the gear position in the manual transmission vehicle and on the gear shifting in the auto transaxle vehicle after computing the engine speed and the vehicle speed signal.

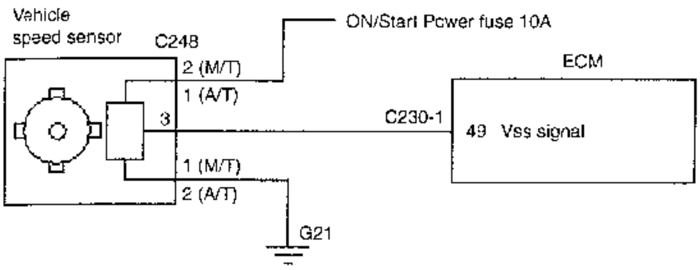
DTC DESCRIPTION

If the CMP signal is not geneated, the ECM judged this as a fault and DTC is set.

DTC DETECTING CONDITION EC9338EE

Item	Detecting Condition	Possible Cause
DTC Strategy	• Rationality check, low	• Open or short in power circuit • Open or short in Vss circuit • Fuse blown • Faulty VSS • Faulty ECM
Enable Conditions	• Engine speed > 3500 rpm and injection quantity > 45 mcc	
Threshold Value	• Vehicle speed signal < 15 Km/h	
Diagnostic Time	• 4 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• No • No • No • No	
Fail safe	• Clutch error monitoring deactivited • Cruise control system and error monitoring deactivited • Idle compensation deactivited in case of the lack of battery voltag	

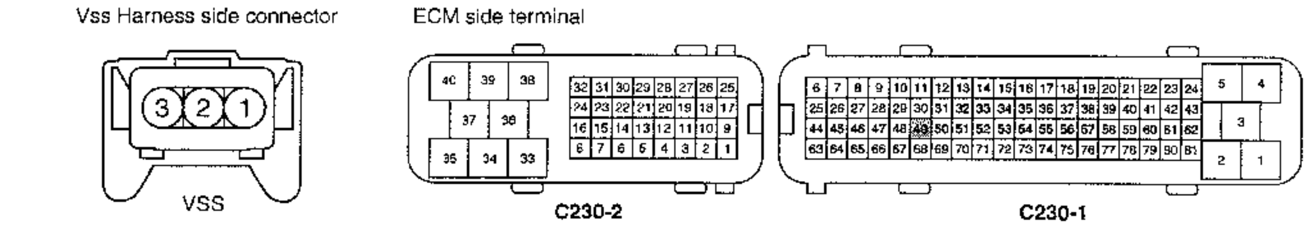
SCHEMATIC DIAGRAM EFACE58B



[Connection Information]

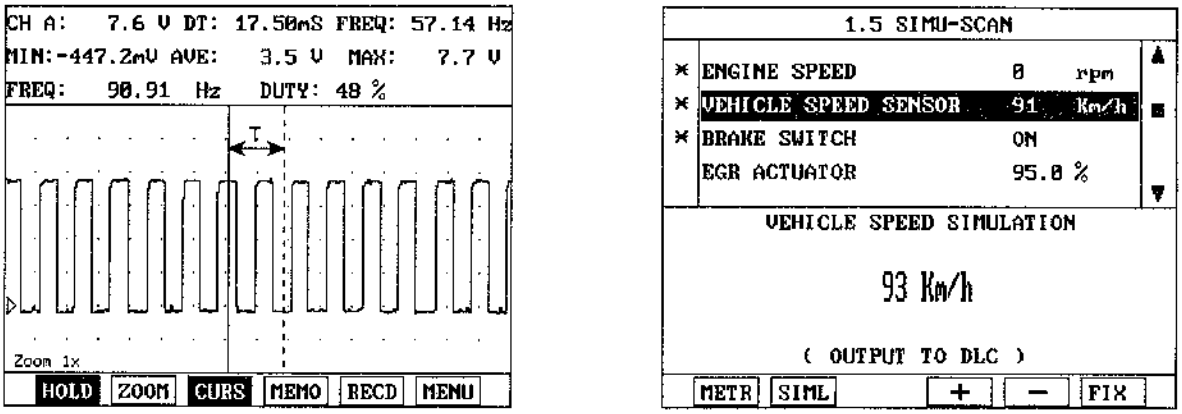
1	C223 Terminal 3 (AT)	Vss power
	G21 (MT)	Vss ground
2	G21 (AT)	Vss ground
	C223 Terminal 2 (MT)	Vss power
3	C230-1 Terminal 49	Vss signal

[CONNECTOR]



E0501-2

SIGNAL WAVEFORM ECAA5392



This test should be inspected after depressing the HOLD mode at the vehicle speed of 120 Km/h.
The time T becomes shorter and frequency increases when the engine speed is increased.
For checking the wiring from the ECM to the speedometer, you should be pressed on the + or - Key in order to make a simulation vehicle speed.
And then, check the vehicle speed current data with the speedometer should be changed.

E0501-3

MONITOR SCANTOOL DATA E1E5CAA9

1. Connect scantool to Data Link Cable (DLC).
2. Warm up engine to normal operating temperature.
3. Monitor "Engine Speed & Vehcle Speed Sensor" parameter on the scantool.

FIG 1

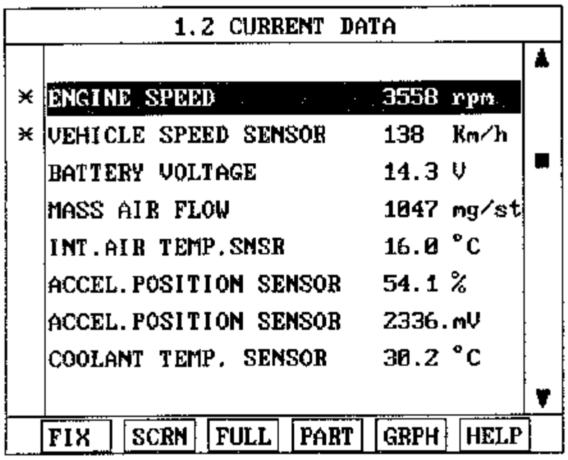


Fig 1) Vehicle speed normal value with engine speed 3550 rpm during driving.

Is the Current data displayed correctly ?

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "W/Harness Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION E5A8EE1E

1. Many malfunctions in the electrical system are caused by poor harness and terminals.

   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

   YES

   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

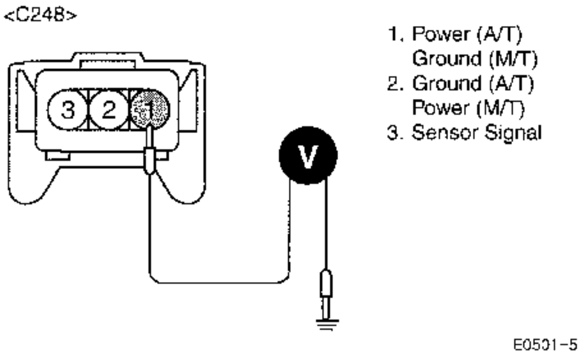
   NO

   Go to "Power Circuit Inspection" procedure.

POWER CIRCUIT INSPECTION E02FBDA2

1. Ignition "OFF" & Engine "OFF".
2. Disconnect VS sensor connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 1(A/T) or 2(M/T) of the VSS harness connector and chassis ground.

Specification : Approx. B+



5. Is the measured voltage within specifications ?

YES

▶ Go to "Signal Circuit Inspection" procedure.

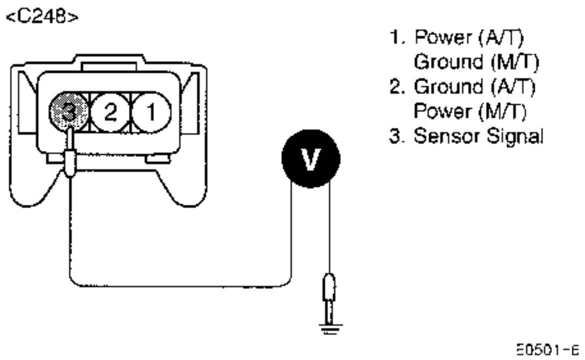
NO

▶ Check for open or short in power harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION E71DF2BB

1. Ignition "OFF" & Engine "OFF".
2. Disconnect VS sensor connector.
3. Measure voltage between terminal 3 of VSS harness connector and chassis ground

Specification : Approx. 12V



4. Is the measuered voltage within specifications ?

YES

▶ Go to "Ground Circuit Inspection" procedure.

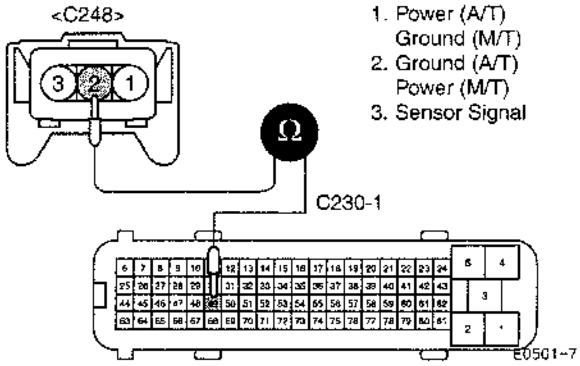
NO

▶ Check for open or short to ground in harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION EADCAA26

1. Ignition "OFF" & Engine "OFF".
2. Disconnect VS sensor and ECM connector.
3. Measure resistance between terminal 2(A/T) or 1(M/T) of VSS harness connector and terminal 49 of ECM harness connector.

Specification : Approx. below 1Ω



4. Is the measured resistance within specifications ?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Check for open in harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E4EE3E35

1. Ignition "OFF" & Engine "OFF".
2. Disconnect VSS connector.
3. Remove VSS and Driven gear from Transaxle.
4. Visually check that VSS driven gear is in good condition.
5. Monitor signal waveform by rotating VSS driven gear with hand after connect connector to VSS.
6. Is the signal waveform generated from VSS ?

YES

▶ Substitute with a known-good ECM and check for proper operation.
If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Check VSS for contamination, deterioration, or damage. Substitute with a known-good.
VSS and check for proper operation. If the problem is corrected, replace VSS and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E9A79D3A

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle within DTC Enable conditions in General information.
3. Are any DTCs present ?

YES

Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

DTC P0503 | VEHICLE SPEED SENSOR - HIGH INPUT

COMPONENT LOCATION EDF4534A

Refer to DTC P0501.

DESCRIPTION E27FC0DE

GENERAL DESCRIPTION

The VSS (Vehicle Speed Sensor) is a hall sensor type. The vehicle speed sensor is buit into the speedometer and converts the transaxle gear revolutions into the pulse signals, which are sent to ECM.

This pulse signal is fed to ECM to be used to determine the vehicle driving or stop condition including the vehicle speed.

The vehicle speed sensor provides ECM with information on the gear position in the manual transmission vehicle and on the gear shifting in the auto transaxle vehicle after computing the engine speed and the vehicle speed signal.

DTC DESCRIPTION

If the CMP signal is not geneated, the ECM judged this as a fault and DTC is set.

DTC DETECTING CONDITION ED0B8EDD

Item	Detecting Condition	Possible Cause
DTC Strategy	• Rationality check, high	• Open or short in power circuit • Open or short to ground in VSS cicuit • Open in ground circuit • Faulty VSS • Faulty ECM
Enable Conditions	• In driving	
Threshold Value	• Vehicle speed signal > 220 Km/h	
Diagnostic Time	• 1 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• No • No • No • No	
Fail safe	• Clutch error monitoring deactivited • Cruise control system and error monitoring deactivited • Idle compensation deactivited in case of the lack of battery voltag	

SCHEMATIC DIAGRAM EA12B56A

Refer to DTC P0501.

SIGNAL WAVEFORM EE000B71

Refer to DTC P0501.

MONITOR SCANTOOL DATA E0D61A7C

Refer to DTC P0501.

TERMINAL & CONNECTOR INSPECTION ECE0CE8B

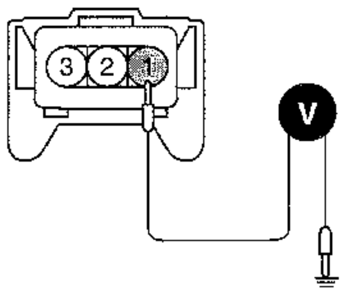
Refer to DTC P0501.

POWER CIRCUIT INSPECTION EF9A9DF7

1. Ignition "OFF" & Engine "OFF".
2. Disconnect VS sensor connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 1(A/T) or 2(M/T) of the VSS harness connector and chassis ground.

Specification : Approx. B+

<C248>



1. Power (A/T)
   Ground (M/T)
2. Ground (A/T)
   Power (M/T)
3. Sensor Signal

E0503-5

5. Is the measured voltage within specifications ?

YES

▶ Go to "Signal Circuit Inspection" procedure.

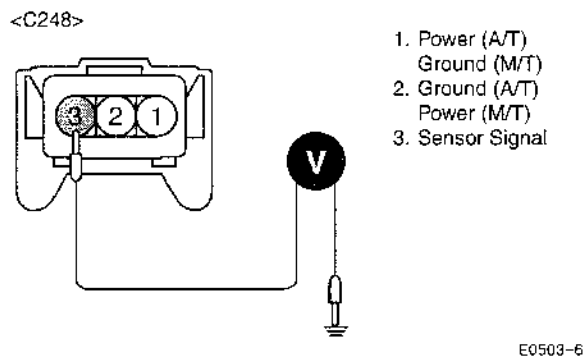
NO

▶ Check for open or short in power harness.
Repair as necessary and go to "Verification is Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION E58E63FF

1. Ignition "OFF" & Engine "OFF".
2. Disconnect VS sensor connector.
3. Measure voltage between terminal 3 of VSS harness connector and chassis ground

Specification : Approx. 12V



4. Is the measuered voltage within specifications ?

YES

▶ Go to "Ground Circuit Inspection" procedure.

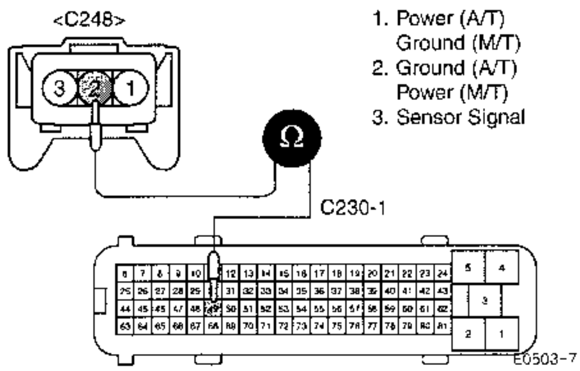
NO

▶ Check for open or short to ground in harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION EF3C8A01

1. Ignition "OFF" & Engine "OFF".
2. Disconnect VS sensor and ECM connector.
3. Measure resistance between terminal 2(A/T) or (M/T) of VSS harness connector and terminal 49 of ECM harness connector.

Specification : Approx. below 1Ω



4. Is the measured resistance within specifications ?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Check for open in harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E69D87A3

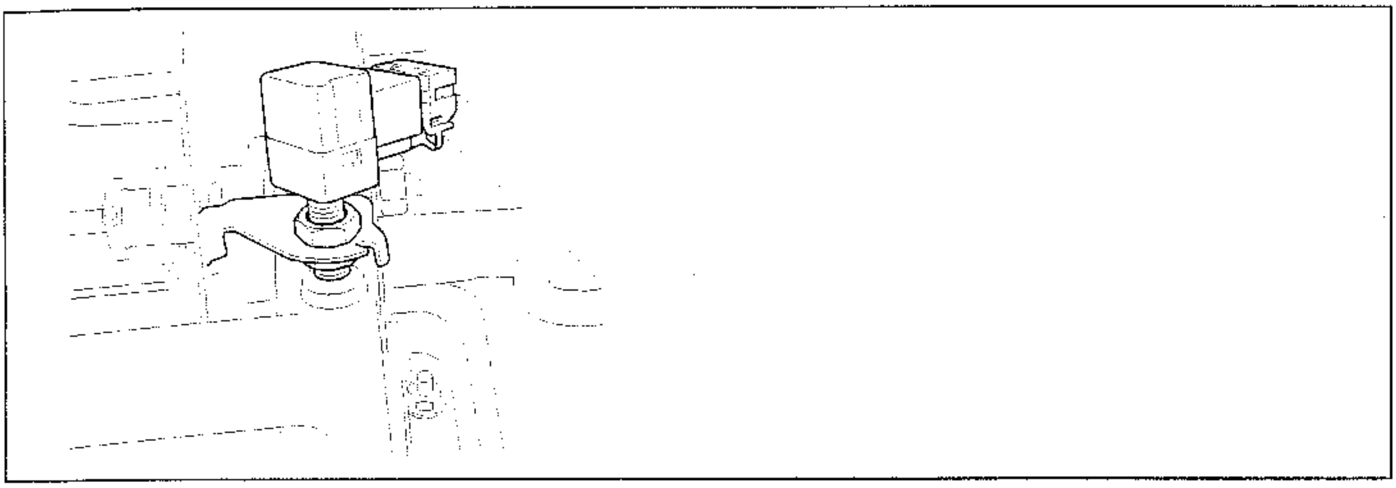
Refer to DTC P0501.

VERIFICATION OF VEHICLE REPAIR E1AD4518

Refer to DTC P0501.

DTC P0504 | BRAKE SWITCH - RANGE/ PERFORMANCE

COMPONENT LOCATION E3E6C32D



P0504-1

DESCRIPTION ECBA3B19

GENERAL DESCRIPTION

The brake switch has 2 contacts. One allows the stop lights to be supplied and the other is used for finding fault and the correlation between the accelerator pedal position and the brake pedal position.

Also, the brake switch has the cancellation of cruise control.

The ECM senses the state of brake operating through brake switch. The redundant brake circuit is actuated when the accel pedal is depressed and the brake pedal depressed.

The ECM will apply a fail safe mode limiting the signal from the accelerator and controlling the injector operation allowing the engine to 1200 rpm only when the brake is released, APS signal is returned and injector operation re-instated.

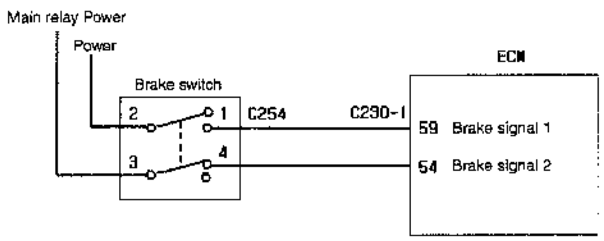
DTC DESCRIPTING

If the brake switch 1 and 2 signal is not geneated normally, the ECM judged this as a fault and DTC is set.

DTC DETECTION CONDITION EFCCEA18

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal check	• Open in brake switch 1 & 2 circuit • Short in brake switch 1 & 2 circuit • Open or short in power circuit • Fuse blown • Faulty brake switch • Faulty ECM
Enable Conditions	• Ignition on	
Threshold Value	• Case 1: brake switch 1 signal and brake switch 2 signal are abnormally correlated after the ignition switch on. • Case 2: brake switch 1 signal and brake switch 2 signal are abnormally correlated during the driving	
Diagnostic Time	• Case 1: 2 sec • Case 2: 180 sec	
MIL Fuel Limit Fuel Cut EGR Off	• No • No • No • No	
Fail safe	• Clutch error monitoring deactivited • Cruise control system and error monitoring deactivited • Idle compensation deactivited in case of the lack of battery voltag	

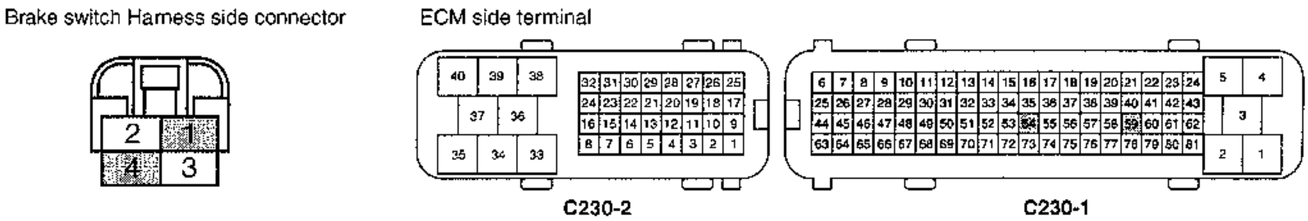
SCHEMATIC DIAGRAM EC5D1EB2



[Connection Information]

1	C230-1 Terminal 59	Brake signal 1
2	M08 Terminal 20	Brake power
3	C253 Terminal 19	Brake signal 2
4	C230-1 Terminal 54	Main relay power

[CONNECTOR]



E0504-2

SIGNAL WAVEFORM EAD285BC

1.2 CURRENT DATA		
* BRAKE SWITCH	ON	
VEHICLE SPEED SENSOR	0	Km/h
FUEL PRESSURE	5.5	bar
FUEL PRESS. REGULATOR	1.0	%
EGR ACTUATOR	95.0	%
BAROMETRIC PRESS.SNSR	101	kPa
CLUTCH SW.(M/T ONLY)	ON	
BOOSTER V-OPERAT'G INJ	0.2	V

FIX SCRN FULL PART GRPH HELP

After the ignition switch on, the brake switch 1 is OFF signal to the ECM and the brake switch 2 is ON signal to the ECM. When depressing the brake pedal, the brake switch 1 is ON signal to the ECM with the brake light and the brake switch 2 is OFF signal to the ECM with the brake light. For checking normal signal from the brake switch 1, you should be checked ON signal on the current data when depressing the brake pedal.

F0504-3

MONITOR SCANTOOL DATA E3990CC6

1. Connect scantool to Data Link Cable (DLC).
2. Monitor "Brake Switch" parameter on the scantool .

FIG 1

1.2 CURRENT DATA		
* BRAKE SWITCH	ON	
VEHICLE SPEED SENSOR	0	Km/h
FUEL PRESSURE	5.5	bar
FUEL PRESS. REGULATOR	1.0	%
EGR ACTUATOR	95.0	%
BAROMETRIC PRESS.SNSR	101	kPa
CLUTCH SW.(M/T ONLY)	ON	
BOOSTER V-OPERAT'G INJ	0.2	V

FIX SCRN FULL PART GRPH HELP

Fig 1) Normal value when depressing brake pedal.

Is the Current data displayed correctly ?

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "W/Harness Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION E15A0AC8

1. Many malfunctions in the electrical system are caused by poor harness and terminals.

   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

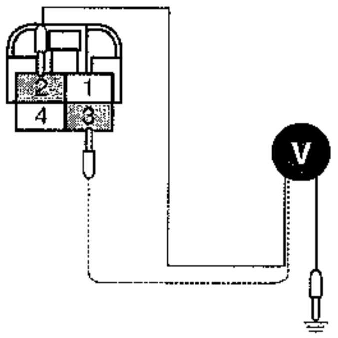
NO

Go to "Power Circuit Inspection" procedure.

POWER CIRCUIT INSPECTION EDE0574C

1. Check for open or short in Power harness
   1) Ignition "OFF" & Engine "OFF".
   2) Disconnect Brake switch connector.
   3) Ignition "ON" & Engine "OFF".
   4) Measure voltage between terminal 2 of the Brake switch harness connector and chassis ground.
   5) Measure voltage between terminal 3 of the Brake switch harness connector and chassis ground.

Specification : B+



1. Brake SW 1 signal
2. Power
3. Power from Relay
4. Brake SW 2 signal

E0504-5

   6) Is the measured voltage within specifications ?

YES

▶ Go to "Ground Circuit Inspection" procedure.

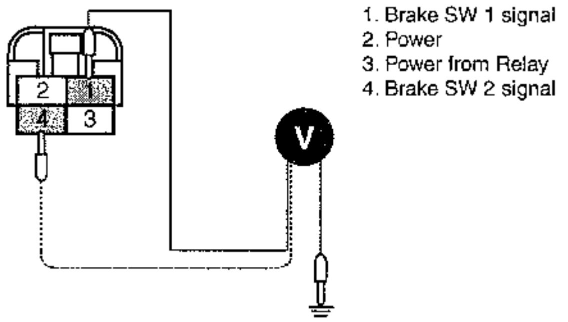
NO

▶ Check for open or short in the power harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION EECAD550

1. Check for short to battery in Brake SW 1 and 2 signal harness.
   1) Ignition "OFF" & Engine "OFF".
   2) Disconnect Brake switch sensor connector.
   3) Ignition "ON" & Engine "OFF"
   4) Measure voltage between terminal 1 of Brake switch harness connector and chassis ground
   5) Measure voltage between terminal 4 of Brake switch harness connector and chassis ground

   Specification : Approx. below 1V



E0504-6

   6) Is the measured voltage within specifications ?

   YES

   ▶ Go to "Check for short to ground in harness" as below.

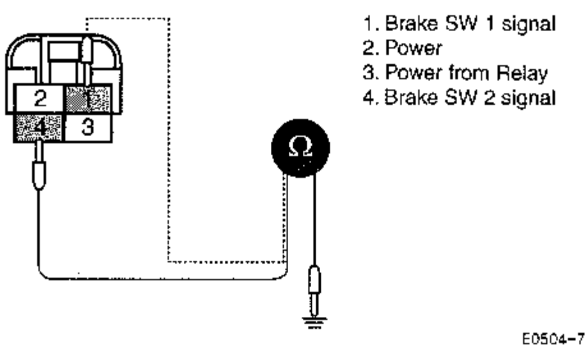
   NO

   ▶ Check for short to battery in harness.
   Repair as necessary and go to "Verification of Vehicle Repair" procedure

2. Check for short to ground in harness.
   1) Ignition "OFF" & Engine "OFF".
   2) Disconnect Brake switch and ECM connector.
   3) Measure resistance between terminal 4 of Brake switch harness connector and chassis ground.

4) Measure resistance between terminal 1 of Brake switch harness connector and chassis ground.

Specification : Infinite



5) Is the measured resistance within specifications ?

YES

▶ Go to "Check for open in harness" as below.

NO

▶ Check for short to ground in harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

3. Check for open in harness

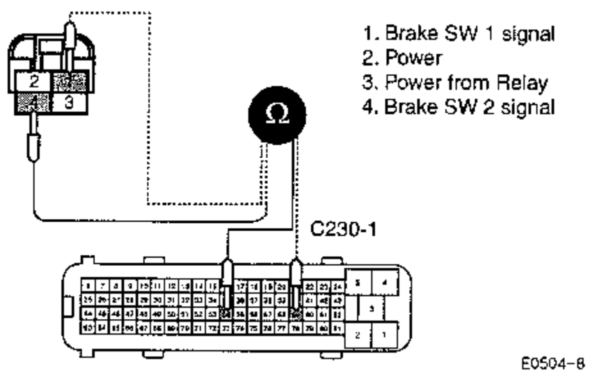
1) Ignition "OFF" & Engine "OFF".

2) Disconnect Brake switch and ECM connector.

3) Measure resistance between terminal 4 of Brake switch harness connector and terminal 54 of ECM harness connector.

4) Measure resistance between terminal 1 of Brake switch harness connector and terminal 59 of ECM harness connector.

Specification : Approx. below 1Ω



4. Is the measured resistance within specifications ?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Check for open in harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EDA44BDE

1. Check Brake Switch
   1) Ignition "OFF".
   2) Disconnect Brake Switch connector.
   3) Check continuity between terminal 1 and 2 of Brake switch connector (Component side).
   4) Check continuity between terminal 3 and 4 of Brake switch connector (Component side).

SPECIFICATION :

Brake Pedal OFF		Brake Pedal ON	
Switch 1	Switch 2	Switch 1	Switch 2
No continuity	Continuity	Continuity	No continuity

   5) Is the measured continuity status within specifications ?

YES

▶ Substitute with a known-good ECM and check for proper operation.
If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Check Brake switch for contamination, deterioration, or damage. Substitute with a known-good Brake switch and check for proper operation. If the problem is corrected, replace Brake switch and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E9C8EA6D

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle within DTC Enable conditions in General information.
3. Are any DTCs present ?

YES

Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

DTC P0562 | SYSTEM VOLTAGE LOW

DESCRIPTION E45F2EEA

GENERAL DESCRIPTION

The charging system includes a battery, generator with a built in regulator, the charging indicator light, and connecting wiring. The generator uses diodes to rectify alternating current (AC) to direct current (DC).

The ECM provides ground to one side of coil of engine main relay and the other side is connected to battery.

The ECM monitors battery voltage and the voltage through engine control relay.

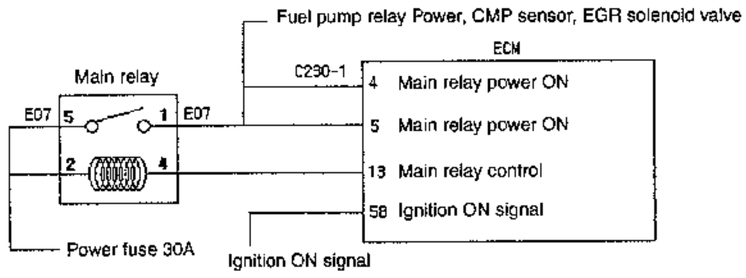
DTC DESCRIPTION

If the signal is above threshold value, the ECM judged this as a fault and DTC is set.

DTC DETECTING CONDITION E04DF5E1

Item	Detecting Condition	Possible Cause
DTC Strategy	• Votage check, low	• Open or short in power(sensing) circuit •.Open or short in Charging warning circuit • Charging warning Lamp • Faulty alternator • Faulty ECM
Enable Conditions	• Ignition on	
Threshold Value	• Battery voltage > 6V	
Diagnostic Time	• 5 sec	
MIL Fuel Limit Fuel Cut EGR Off	• No • No • No • Yes	
Fail safe	• Battery voltage is fixed at about 7.9 V as a basic value	

SCHEMATIC DIAGRAM ECFBAC84

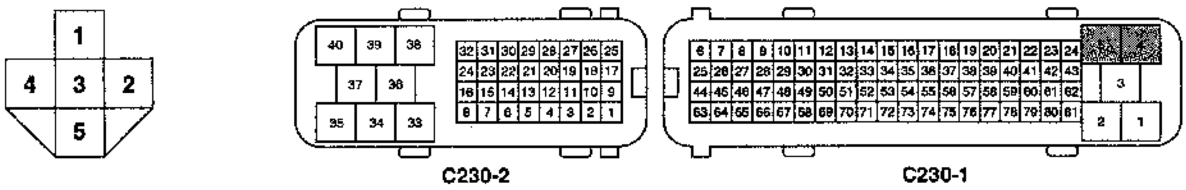


[Connection Information]

1	C230-1 Terminal 4,5	Main relay supply power
2	Power fuse 30A	Main relay power
3	-	-
4	C230-1 Terminal 13	Main relay control
5	Power fuse 30A	Main relay power

[CONNECTOR]

Main relay Harness side connector ECM side terminal



MONITOR SCANTOOL DATA

1. Connect scantool to Data Link Cable (DLC).
2. Monitor "Brake Switch" parameter on the scantool .

FIG 1

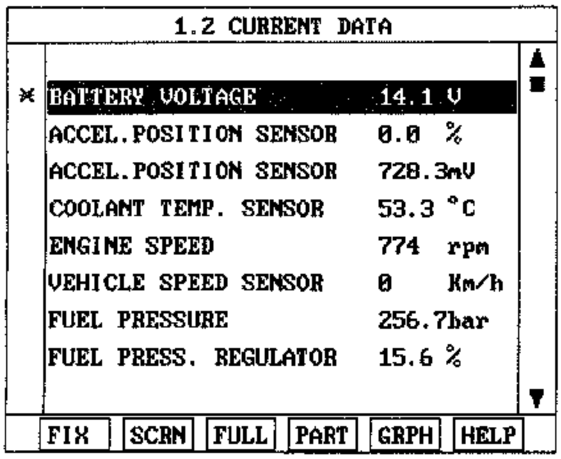


Fig 1) Normal value at idle.

Is the Current data displayed correctly ?

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "W/Harness Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION E2B0FF98

1. Many malfunctions in the electrical system are caused by poor harness and terminals.
   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

   YES

   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

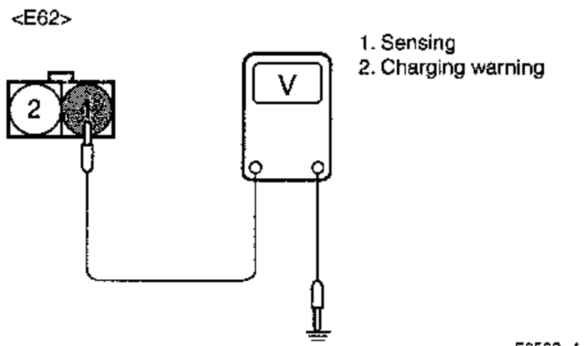
   NO

   Go to "Power Circuit Inspection" procedure.

POWER CIRCUIT INSPECTION EFB3D50F

1. Check for open or short in Power harness
   1) Ignition "OFF".
   2) Disconnect Alternator connector.
   3) Ignition "ON" & Engine "OFF".
   4) Measure voltage terminal 1 of Alternator harness connector and chassis ground.

Specification : Approx. 11.5V~13.0V



E0562-4

5) Is the measured voltage within specifications ?

YES

▶ Go to " Check for open or short in Charging warning harness" as below.

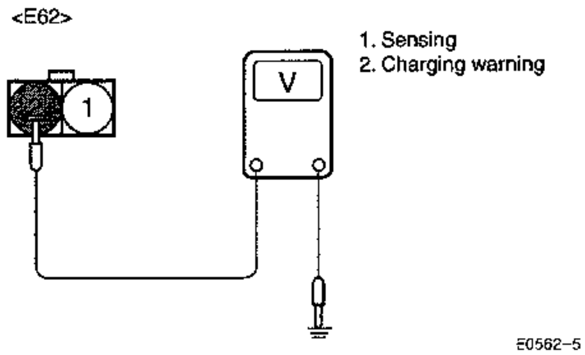
NO

▶ Check for open or short in the Chargnig warning harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for open or short in Charging warning harness.

1) Ignition "OFF" & Engine "OFF".
2) Disconnect Alternator connector.
3) Ignition "ON" & Engine "OFF".
4) Measure voltage terminal 2 of Alternator narness connector and chassis ground.

Specification : Approx. 10.5V~12.0V



5) Is the measured voltage within specifications ?

YES

▶ Go to "System Inspection" procedure.

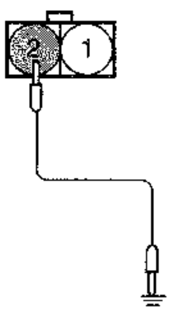
NO

▶ Check for open or short in the Charging warning harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

SYSTEM INSPECTION E50ED3A4

1. Check Chargnig warning lamp operation.
   1) Ignition "OFF".
   2) Disconnect Alternator connector.
   3) Jump terminal 2 of Brake switch and chassis ground with jumper wire.

Specification : Warning Lamp ON when grounding



E0562-6

   4) Is the warning lamp turned ON ?

YES

▶ Go to " Check for voltage drop on Alternator B+ Cable" as below.

NO

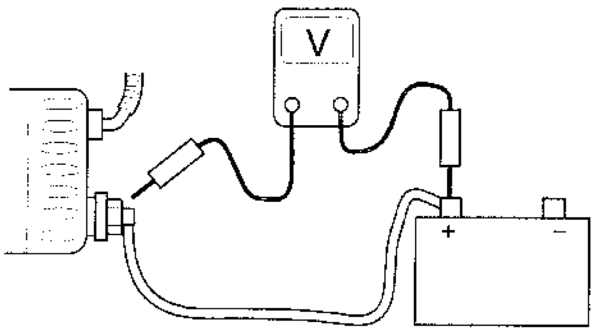
▶ Check warning lamp and then, repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for voltage drop on Alternator B+ Cable.
   1) Ignition "ON" & Engine " ON ".
   2) Measure voltage between Battery + and Alternator B+.

NOTE

+ probe : Alternator B+, - probe : Battery +

Specification : Approx. below 0.2V(200mV)



E0562-7

3) Is the measured voltage within specifications ?

YES

▶ Go to " Component Inspection" procedure.

NO

▶ Check warning lamp connector for contamination, corrosion or damage warning lamp and then, repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EF3AFAB3

1. Check Charging voltage.
   1) Ignition "OFF" & Engine "OFF".
   2) Check belt tension for alternator.
   3) Check Battery terminal, Fusible Link and Alternator B+ for poor connection and corrosion.
   4) Ignition "ON" & Engine "ON".
   5) Turn ON electrical Load such as Head Lamp, Blower Motor and Defroster.
   6) Measure battery voltage when engien is more than 2000 rpm.

   Specification : 12.5 ~ 14.5V

   7) Is the measured voltage within specifications ?

YES

▶ Substitute with a known-good ECM and check for proper operation.
If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Check height and condition of Brake switch. Substitute with a known-good Brake switch and check for proper operation. If the problem is corrected, replace Brake switch and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR ECC1C828

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle within DTC Enable conditions in General information.
3. Are any DTCs present ?

YES

Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

DTC P0563 | SYSTEM VOLTAGE HIGH

DESCRIPTION E139AD3F

GENERAL DESCRIPTION

Refer to DTC P0562.

DTC DESCRIPTION

If the signal is above threshold value, the ECM judged this as a fault and DTC is set.

DTC DETECTING CONDITION E4E5BB3B

Item	Detecting Condition	Possible Cause
DTC Strategy	• Votage check, low	• Open or short in power(sensing) circuit • Charging warning Lamp • Faulty alternator • Faulty ECM
Enable Conditions	• Ignition on	
Threshold Value	• Battery voltage > 17.5V	
Diagnostic Time	• 5 sec	
MIL Fuel Limit Fuel Cut EGR Off	• No • No • No • Yes	
Fail safe	• Battery voltage is fixed at about 7.9 V as a basic value	

SCHEMATIC DIAGRAM E8A95A3A

Refer to DTC P0562.

MONITOR SCANTOOL DATA E32FAFCD

Refer to DTC P0562.

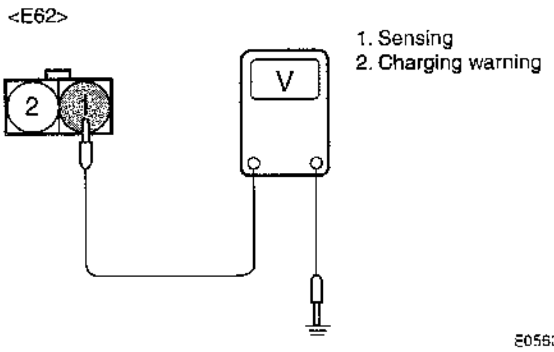
TERMINAL & CONNECTOR INSPECTION E91E75D6

Refer to DTC P0562.

POWER CIRCUIT INSPECTION ED91D26B

1. Check for open or short in sensing harness.
   1) Ignition "OFF".
   2) Disconnect Alternator connector.
   3) Ignition "ON" & Engine "OFF".
   4) Measure voltage terminal 1 of Alternator harness connector and chassis ground.

Specification : Approx. 11.5V~13.0V



E0563-4

   5) Is the measured voltage within specifications ?

YES

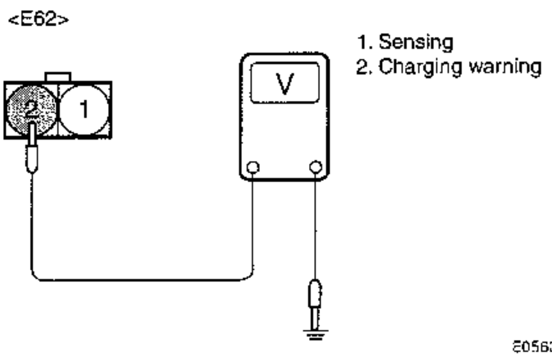
▶ Go to " Check for open or short in Charging warning harness" as below.

NO

▶ Check for open or short in the Chargnig warning harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for open or short in Charging warning harness.
   1) Ignition "OFF" & Engine "OFF".
   2) Disconnect Alternator connector.
   3) Ignition "ON" & Engine "OFF".
   4) Measure voltage terminal 2 of Alternator narness connector and chassis ground.

Specification : Approx. 10.5V~12.0V



E0563-5

5) Is the measured voltage within specifications ?

YES

▶ Go to "System Inspection" procedure.

NO

▶ Check for open or short in the Charging warning harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

SYSTEM INSPECTION EA2490EB

Refer to DTC P0562.

COMPONENT INSPECTION E5CDC876

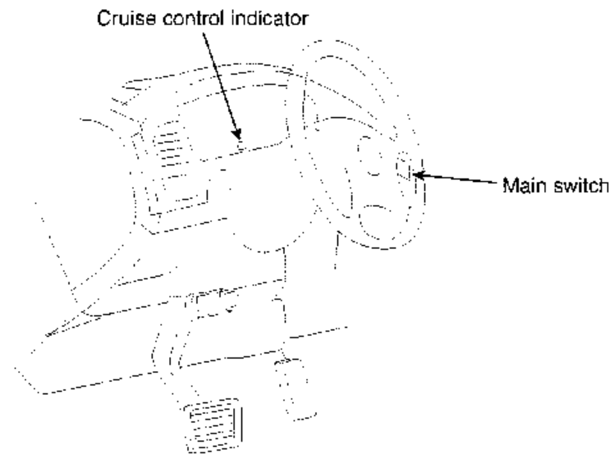
Refer to DTC P0562.

VERIFICATION OF VEHICLE REPAIR E7F5467C

Refer to DTC P0562.

DTC P0564 | CRUISE CONTROL SWITCH - LOW & HIGH INPUT, RANGE/ PERFORMANCE

COMPONENT LOCATION E47F23F0



DESCRIPTION

GENERAL DESCRIPTION

The cruise control system keeps the vehicle running at a fixed speed until a signal canceling this fixed speed cancelling signalis received.

When the main switch "AUTO CRUISE" is turned on with vehicle in the running mode, the battery voltage is applied to the ECM. When a signal from the control switch is input to the ECM while the vehicle is in state, the cruise control actuator is activited to operate the system.

Also, while the system is operating, "AUTO CRUISE" indicator lamp in the meter assembly lights up.

In case of the cruise control system failure, the engine symptoms will occur acceleration failure and vehicle speed setting failure.

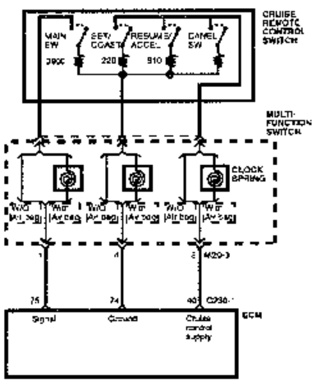
DTC DESCRIPTION

If the signal exceeds threshold value, the ECM judged this as a fault and DTC is set.

DTC DETECTING CONDITING EC1318F3

Item	Detecting Condition	Possible Cause
DTC Strategy	• Votage check, low or high	• Open or short in cruise control circuit • Faulty cruise control switch • Faulty ECM
Enable Conditions	• Engine run	
Threshold Value	• Case 1 : Output signal < 250 mV • Case 2 :Output signal > 4.9 V • Case 3 :If the vehicle speed governer is off when the resume inputs or if the vehicle speed governer is off when the cruise control SET+/SET- switch inputs.	
Diagnostic Time	• Case 1 : 60 sec • Case 2 : 0.5 sec • Case 3 : 1 sec	
MIL Fuel Limit Fuel Cut EGR Off	• No • No • No • No	

SCHEMATIC DIAGRAM EF008DAC



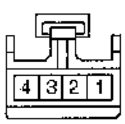
[Connection Information]

1	C230-1 Terminal 75	Cruise Control Signal
2	-	-
3	C230-1 Terminal 40	Cruise Control Power
4	C230-1 Terminal 74	Cruise Control Ground

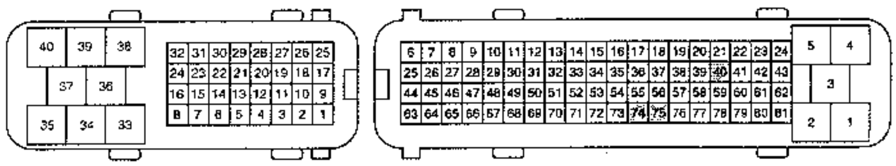
[CONNECTOR]

Multi-Function switch harness side connector

M20-3



ECM side terminal



C230-2 **C230-1**

E0564-2

TERMINAL AND CONNECTOR INSPECTION E2D7930E

1. Many malfunctions in the electrical system are caused by poor harness and terminals.

   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

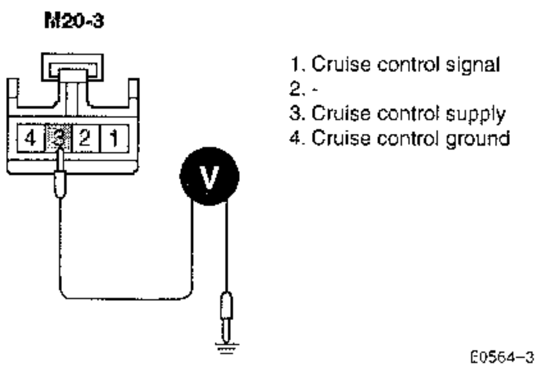
NO

Go to "Power Circuit Inspection" procedure.

POWER CIRCUIT INSPECTION E0A8001F

1. Check for open or short in harness
   1) Ignition "OFF".
   2) Disconnect multi-function switch connector.
   3) Ignition "ON" & Engine "OFF".
   4) Measure voltage between terminal 3 of the multi-function switch harness connector and chassis ground.

Specification : Approx. B+



   5) Is the measured voltage within specifications ?

YES

▶ Go to "Signal Circuit Inspection" procedure.

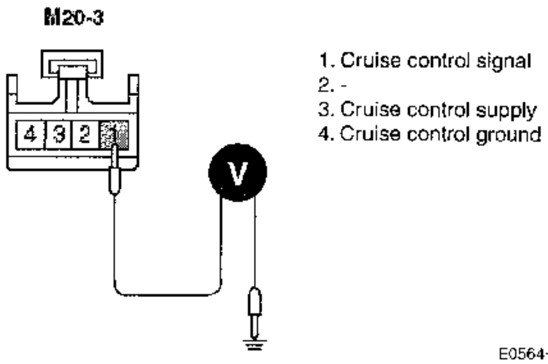
NO

▶ Check for open or short to ground in power harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION E5B857BC

1. Check for open or short in signal harness
   1) Ignition "OFF" & Engine "OFF".
   2) Disconnect Multi-function switch connector.
   3) Measure voltage between terminal 1 of the multi-function switch harness connector and chassis ground.

Specification : Infinite



E0564-4

   4) Is the measured voltage within specifications ?

YES

▶ Go to "Ground Circuit Inspection" procedure.

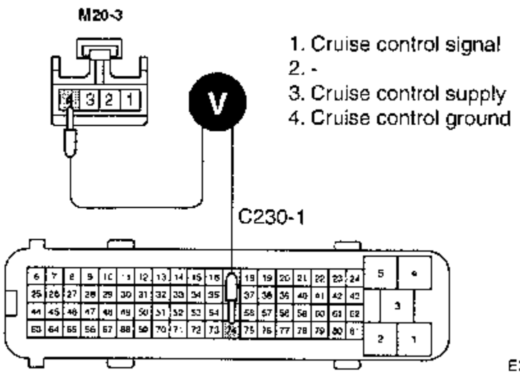
NO

▶ Check for open or short to ground in signal harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION E78FD521

1. Ignition "OFF".
2. Disconnect Multi-function switch and ECM connector.
3. Measure resistance between terminal 4 of the multi-function switch connector and terminal 74 of ECM harness connector.

Specification : Approx. below 1Ω



E0564-5

4. Is the measured resistance within specifications ?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Check for open in harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION ED6233CE

1. Check Cruise remote control switch
   1) Ignition "OFF".
   2) Disconnect ECM connector.
   3) Measure resistance between terminal 74 and 75 of ECM harness connector after Main switch ON.
   4) Main switch "OFF" and then measure resistance between terminal 40 and 74 of ECM harness connector after SET/COAST switch ON.
   5) SET/COAST switch "OFF" and then, measure resistance between terminal 40 and 74 of ECM harness connector after RESUME/ACCEL switch ON.

SPECIFICATION :

Main Switch	SET/COAST Switch	RESUME/ACCEL Switch
390Ω	220Ω	910Ω

   6) Is the measured resistance within specifications ?

YES

▶ Substitute with a known-good ECM and check for proper operation.
If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Substitute with a known-good Cruise Remote control switch and check for proper operation.
If the problem is corrected, replace Cruise Remote control switch and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E99DE0CE

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle within DTC Enable conditions in General information.
3. Are any DTCs present ?

YES

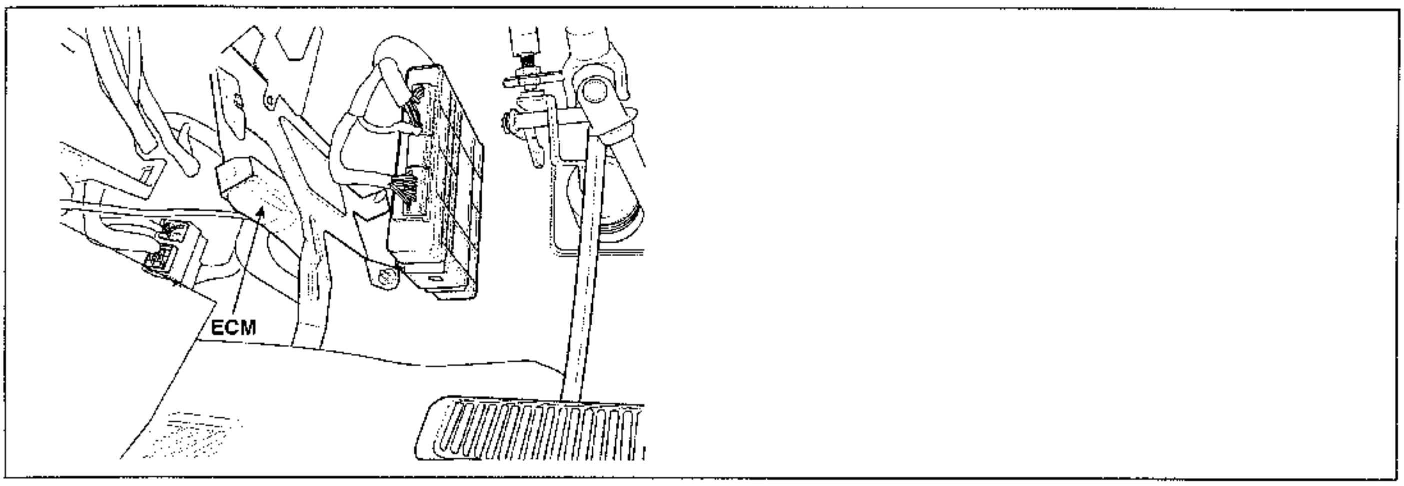
Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

DTC P0600 | CAN COMMUNICATION BUS

COMPONENT LOCATION E4AE2841



E0600-1

DESCRIPTION EAF4FD5B

GENERAL DESCRIPTION

The ECM communicates over the CAN with the EMS(Engine Management System), TCS(Traction Control System) an-d

TCM(Transmission Control Moudle). Through CAN, only two Lines are required to achieve the same function. The info-rmation is in digital format . This method does not use a integrated ECM.

Input signals to TCM through "CAN communication" are as follows.

▶ Engine rpm, TPS signal, A/C signal, WTS signal, AFS signal, Vss signal, Shift holding signal (FTCS ON) Output sig-nals from TCM through "CAN communication" are as follows.

▶ Request signal for torque reduction, ATF temperature, TCM type, TCM error or not, damper clutch on, off/gear pos-ition.

In case of the CAN failure, the engine symptoms will occur the corrupted torque reduction signal information, shift shock and increasing engine rpm abruptly.

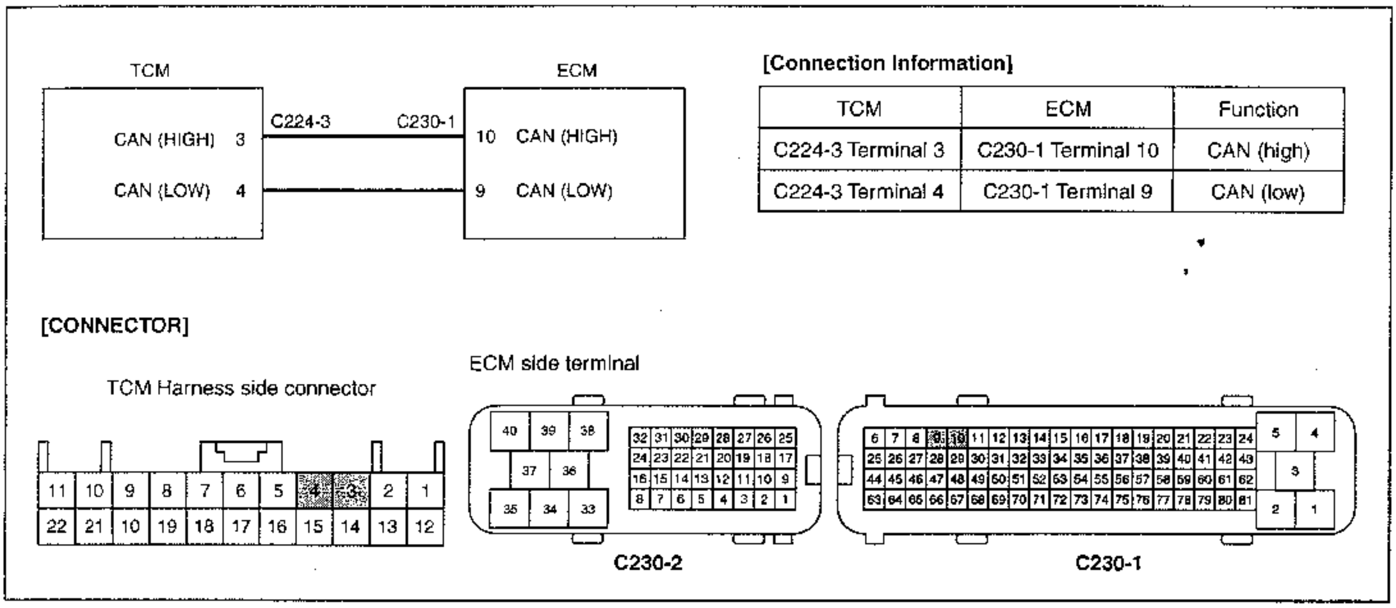
DTC DESCRIPTION

If the CAN communication is generated threshold value, the ECM judged this as a fault and DTC is set.

DTC DETECTING CONDITION EB4AA3D5

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal check, high and low	• Open in signal circuit • Short to ground in signal circuit • Faulty TCM • Faulty ECM
Enable Conditions	• Ignition on	
Threshold Value	• Error between ECM and TCM communication.	
Diagnostic Time	• 1 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• No • No • No • No	

SCHEMATIC DIAGRAM EEE4CA64

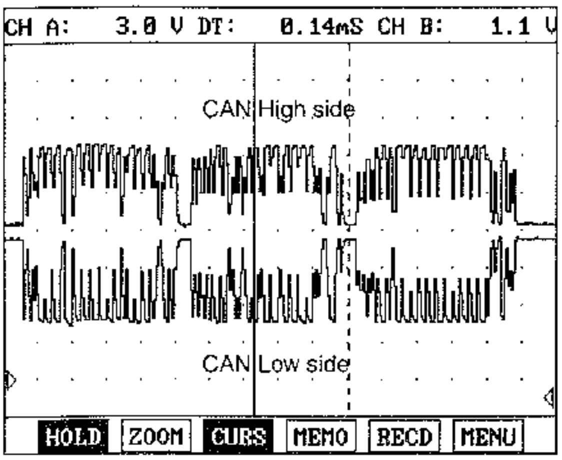


[Connection Information]

TCM	ECM	Function
C224-3 Terminal 3	C230-1 Terminal 10	CAN (high)
C224-3 Terminal 4	C230-1 Terminal 9	CAN (low)

E0600-2

SIGNAL WAVEFORM EB84F8E9



This test should be inspected after depressing the HOLD mode while idling.
In this CAN communication signal waveform, it is impossible to read through by displaying the scantool.
If unstable waveform pattern with non-uniform frequency or no signal, replace the ECM or the TCM after checking the wiring harness.

E0600-3

TERMINAL AND CONNECTOR INSPECTION EF7BDDEF

1. Many malfunctions in the electrical system are caused by poor harness and terminals.

   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

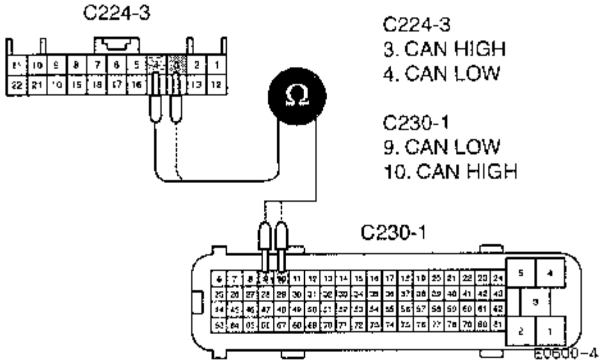
NO

Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION E5D64B8D

1. Check for open in harness
   1) Ignition "OFF" & Engine "OFF".
   2) Disconnect ECM & TCM connector.
   3) Measure resistance between terminal 4 of TCM harness connector and terminal 9 of ECM harness connecto-r.
   4) Measure resistance between terminal 3 of TCM harness connector and terminal 10 of ECM harness connect-or.

Specification : Approx. below 1Ω



   5) Is the measured resistance within specifications ?

YES

▶ Go to "Check for short to ground in harness" as below.

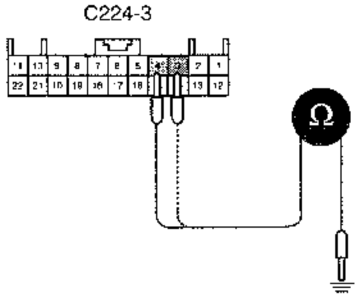
NO

▶ Check for open in the signal harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to ground in harness.
   1) Ignition "OFF" & Engine "OFF".
   2) Disconnect TCM,ECM, TCCU and HCU connector.
   3) Measure resistance between terminal 4 of TCM harness connector and chassis ground.

4) Measure resistance between terminal 3 of TCM harness connector and chassis ground.

Specification : Approx. 5V



E0600-5

5) Is the measured resistance within specificaitons ?

YES

▶ Go to "Component Inspection" procedure.

NO

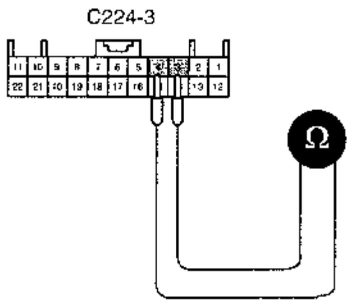
▶ Check for short to ground in signal harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E989E094

1. Check resistance
   1) Ignition "OFF" & Engine "OFF".
   2) Disconnect TCM connector.
   3) Measure resistance between terminal 3 and 4 of TCM harness connector.

SPECIFICATION

Not TCS, 4WD			TCS, 4WD
ECM & TCM connected	ECM connected only	TCM connected only	ECM & TCM connected
60Ω ± 1Ω	120Ω ± 2Ω	120Ω ± 2Ω	120Ω ± 2Ω



E0600-6

4) Is the measured resistance within specifications ?

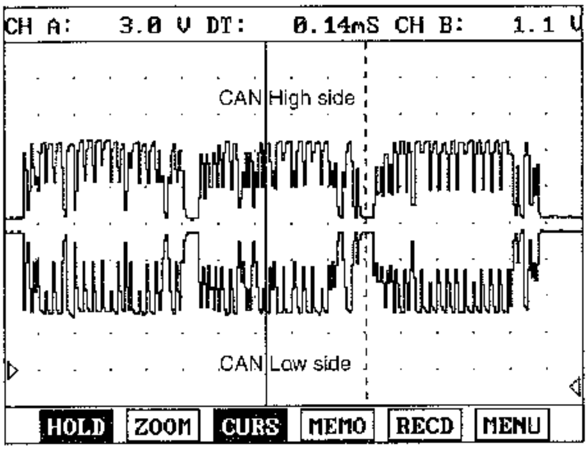
YES

▶ Go to "Check signal waveform" as below.

NO

▶ Substitute with a known-good ECM and check for proper operation.
If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.

2. Check signal waveform
   1) Ignition "OFF" & Engine "OFF".
   2) Disconnect ECM connector.
   3) Monitor signal waveform at terminal 3 and 4 of TCM connector simultaneously.



   4) Are CAN signals generated correctly ?

YES

▶ Thoroughly check connectors for looseness, poor connection,bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Substitute with a known-good ECM and check for proper operation.
If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EFEA4076

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle within DTC Enable conditions in General information.
3. Are any DTCs present ?

YES

Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

DTC P0602 | EEPROM - PROGRAMMING ERROR

COMPONENT LOCATION E468AE8E

Refer to DTC P0600.

DESCRIPTION EEA5B690

GENERAL DESCRIPTION

The ECM function switches valid for the whole driving cycle are selected in the initialization of the background test and are made available in the corresponding messages.

An ECM ROM malfunction is detected by using a checksum technique for verifying data.

Digital data is composed of zeros and ones. A checksum is the total of all ones in a string of data.

By comparing the checksum value with a stored value, a malfunction can be detected.

In case of the EEPROM error, the engine symptoms will occur the running engine stall and the starting impossible.

DTC DESCRIPTION

If the ECM is generated threshold value, the ECM judged this as a fault and DTC is set.

DTC DETECTING CONDITION E1C6DC99

Item	Detecting Condition	Possible Cause
DTC Strategy	• ECM check	• Faulty ECM
Enable Conditions	• Ignition on	
Threshold Value	• EEPROM - Write error	
Diagnostic Time	• 0 sec	
MIL Fuel Limit Fuel Cut EGR Off	• Yes • No • Yes • No	

TERMINAL & CONNECTOR INSPECTION E659AAAC

1. Many malfunctions in the electrical system are caused by poor harness and terminals.

   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to "Component Inspection" procedure.

COMPONENT INSPECTION E24DE8AC

1. Check ECM.
   1) Ignition "OFF" & Engine "OFF".
   2) Disconnect ECM from vehicle.
   3) Substitute with a known-good ECM and check for proper operation.
   4) Is the problem corrected?

      YES

      ▶ Replace ECM and then go to "Verification of Vehicle Repair" procedure.

      NO

      ▶ Thoroughly check connectors for looseness, poor connection,bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EF20651A

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle within DTC Enable conditions in General information.
3. Are any DTCs present ?

YES

Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

DTC P0603 | EEPROM - COMMUNICATION & MEMORY ERROR

COMPONENT LOCATION EC54A3BF

Refer to DTC P0600.

DESCRIPTION EFDCD02C

GENERAL DESCRIPTION

The ECM function switches valid for the whole driving cycle are selected in the initialization of the background test and are made available in the corresponding messages.

An ECM ROM malfunction is detected by using a checksum technique for verifying data.

Digital data is composed of zeros and ones. A checksum is the total of all ones in a string of data.

By comparing the checksum value with a stored value, a malfunction can be detected.

In case of the EEPROM error, the engine symptoms will occur the running engine stall and the starting impossible.

DTC DESCRIPTION

If the ECM is generated threshold value, the ECM judged this as a fault and DTC is set.

DTC DETECTING CONDITION EDDBBE35

Item	Detecting Condition	Possible Cause
DTC Strategy	• ECM check	• Faulty ECM
Enable Conditions	• Ignition on	
Threshold Value	• Case 1:EEPROM - communication error • Case 2:EEPROM - calibration error • Case 3:EEPROM - code word is incorrect or missing	
Diagnostic Time	• Case 1: 0 sec • Case 2: 0 sec • Case 3: 0 sec	
MIL Fuel Limit Fuel Cut EGR Off	• Yes • Yes • No • No	

TERMINAL & CONNECTOR INSPECTION EB0FC5CE

1. Many malfunctions in the electrical system are caused by poor harness and terminals.

   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to "Component Inspection" procedure.

COMPONENT INSPECTION EB3B6CCE

1. Check ECM.
   1) Ignition "OFF" & Engine "OFF".
   2) Disconnect ECM from vehicle.
   3) Substitute with a known-good ECM and check for proper operation.
   4) Is the problem corrected?

   YES

   ▶ Replace ECM and then go to "Verification of Vehicle Repair" procedure.

   NO

   ▶ Thoroughly check connectors for looseness, poor connection,bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EEC2B1D1

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle within DTC Enable conditions in General information.
3. Are any DTCs present ?

YES

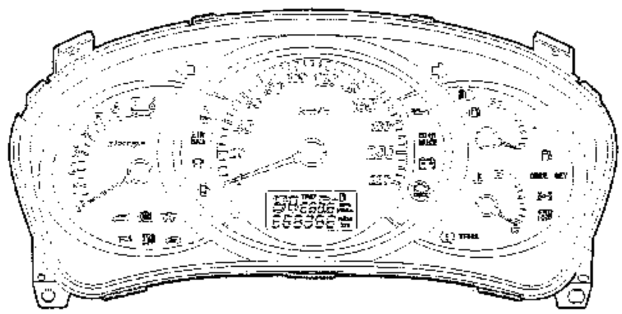
Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

DTC P0650 | MALFUNCTION INDICATION LAMP(MIL) CONTROL CIRCUIT MALFUNCTION

COMPONENT LOCATION E3398FDB



F0650-1

DESCRIPTION E6E60665

GENERAL DESCRIPTION

Failure diagnosis results are output as diagnosic codes and are displayed on malfuction indicator lamp.

When the diagnostic code output terminal is turned to the ON position.

The MIL is the error lamp demanded by the EOBD for exhaust-relevant errors.

Energizing by the MIL is done under the MIL lamp test is active or a path with the characteristic "MIL blinking" is preliminary entered in the memory. Then the MIL blinks.In case of the engine check failure, the engine check lamp will not illuminates to notify the driver.

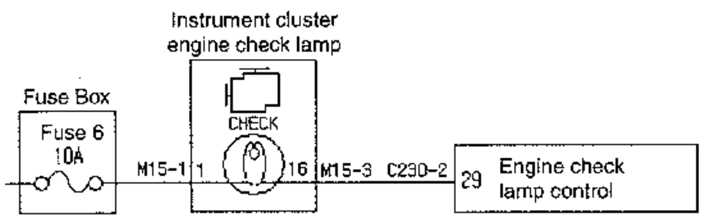
DTC DESCRIPTION

If the engine check lamp circuit is generated threshold value, the ECM judged this as a fault and DTC is set.

DTC DETECTING CONDITION E4CEA377

Item	Detecting Condition	Possible Cause
DTC Strategy	• Circuit continuity check	• Short to MIL control circuit • Faulty Bulb • Faulty ECM
Enable Conditions	• Ignition on	
Threshold Value	• Short for engine check lamp control circuit	
Diagnostic Time	• 1 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• No • No • No • No	

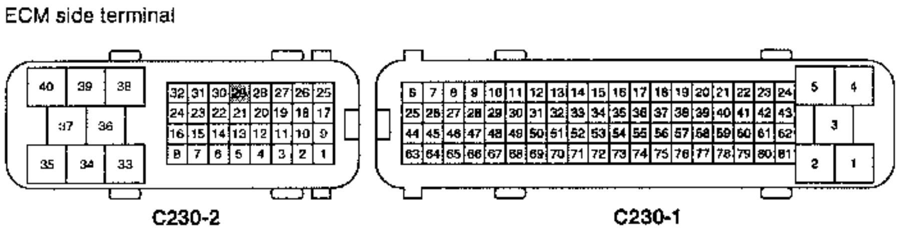
SCHEMATIC DIAGRAM E957DAE2



[Connection Information]

1	I/P-C Terminal 2	Engine check lamp power
2	C230-2 Terminal 29	Engine check lamp control

[CONNECTOR]



E0650-2

SIGNAL WAVEFORM & DATA E11E588F

1.4 ACTUATION TEST	
MIL(ENGINE CHECK)	
DURATION	UNTIL STOP KEY
METHOD	ACTIVATION
CONDITION	IG.KEY ON ENGINE RUNNING
PRESS [STRT], IF YOU ARE READY ! SELECT TEST ITEM USING UP/DOWN KEY	
STRT	STOP

Battery voltage is applied to the engine check lamp by the ECM in order to notify the driver that the ECM is detecting the DTC.
For checking short in the wire between the fuse (10A) and the ECM, the START key should be pressed in the scan tool actuation test mode. And then make sure that the engine check lamp comes ON and stays during the "NOW ACTIVATING" indication

E0650-3

TERMINAL & CONNECTOR INSPECTION EF91C5FD

1. Many malfunctions in the electrical system are caused by poor harness and terminals.

   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

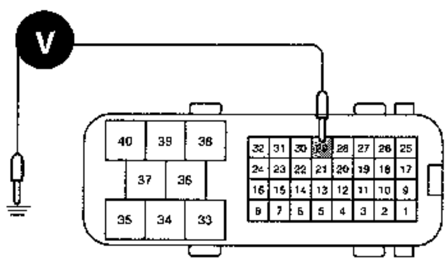
Go to " Control Circuit Inspection " procedure.

CONTROL CIRCUIT INSPECTION E22573FD

1. Ignition "OFF" & Engine "OFF".
2. Disconnect ECM connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 29 of ECM harness connector and chassis ground.

Specification : Approx. 10.8 ~ 13.0V

29. MIL control



E0650-4

5. Is the measured voltage within specifications ?

YES

▶ Go to " Component Inspection " procedure.

NO

▶ Check for short to battery in control harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure .

COMPONENT INSPECTION E7CD210F

1. Check MIL.
   1) Ignition "ON" & Engine "OFF".
   2) Disconnect ECM connector.
   3) Jump terminal 29 of ECM harness connector and chassis ground with jumper wire.
   4) Is the MIL turned ON ?

      YES

      ▶ Go to " Check bulb " as below.

      NO

      ▶ Check for short to battery in the signal harness.
      Repair as necessary and go to "Verification of Vehicle Repair" procedure.
2. Check Bulb.
   1) Ignition "OFF" & Engine "OFF" .
   2) Remove Instrument Panel and then remove bulb from instrument panel.
   3) Apply 12 voltage to the bulb and check that bulb is turned ON.
   4) Is the bulb turned ON ?

      YES

      ▶ Substitute with a known-good ECM and check for proper operation.
      If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.

      NO

      ▶ Substitute with a known-good bulb and check for proper operation.
      If the problem is corrected, replace bulb and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR ECBB9F10

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle within DTC Enable conditions in General information.
3. Are any DTCs present ?

   YES

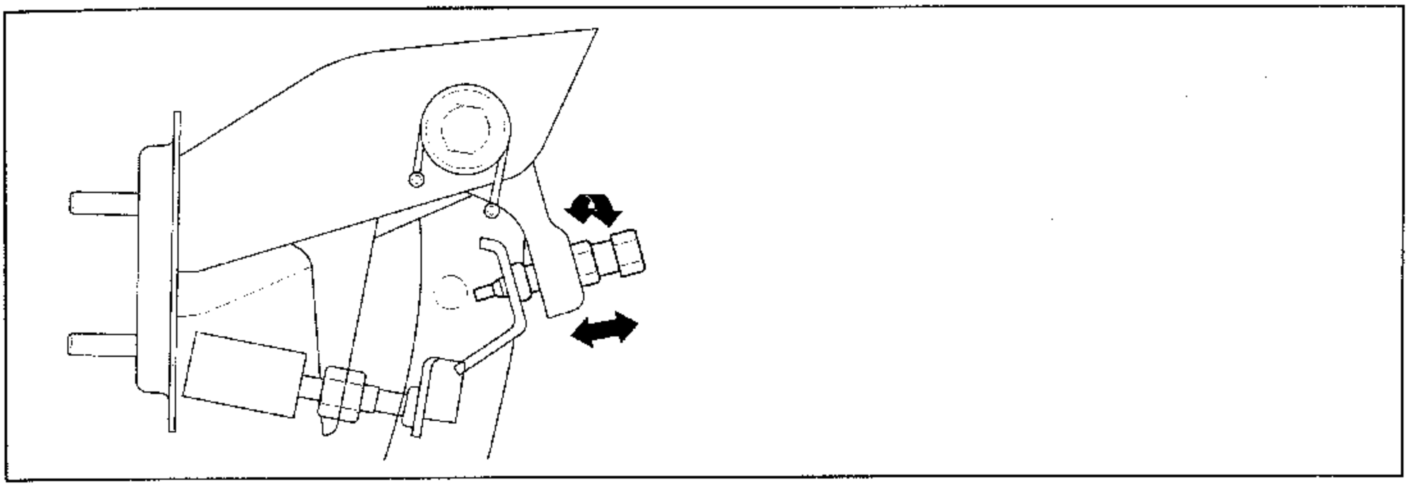
   Go to the applicable troubleshooting procedure.

   NO

   System is performing to specification at this time.

DTC P0704 | CLUTCH PEDAL S/W MALFUNCTION

COMPONENT LOCATION E67F16AC



P0704-11

DESCRIPTION ECCA1B2D

GENERAL DESCRIPTION

The clutch switch is used to detect gear change and impende engine load signals including de-clutching, first gear, and initial acceleration. The clutch switch also controls cancellation of cruise control.

To prevent engine rpm surging when de-clutching (during gear changes), the ECM adjusts injector operation.

To check the normal signal from the clutch switch, you should check ON signal current data while depressing the clutch pedal.

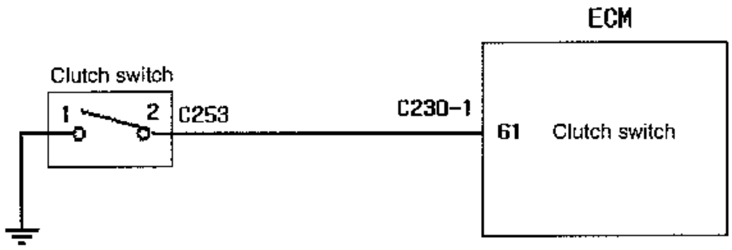
DTC DESCRIPTION

If the clutch switch signal generates, the ECM judged this as a fault and DTC is set.

DTC DETECTING CONDITION EF4AEAB0

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal check	• Open or short in power circuit • Open in ground circuit • Faulty clutch switch • Faulty ECM
Enable Conditions	• Vehicle speed > 90 Km/h	
Threshold Value	• No clutch signal	
Diagnostic Time	• 0 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• No • No • No • No	
Fail safe	• Cruise control system deactivited	

SCHEMATIC DIAGRAM EB01DFCE



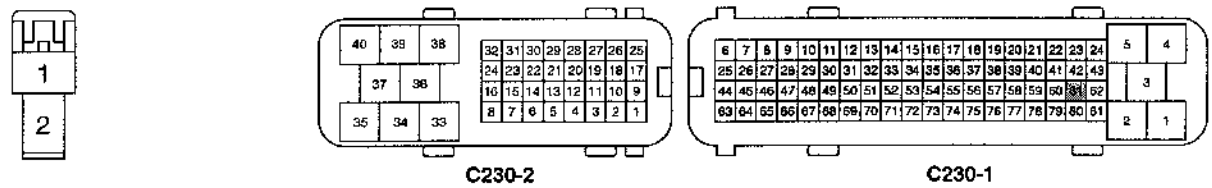
[Connection Information]

1	G07 Body ground	Clutch switch ground
2	C230-1 Terminal 61	Clutch switch signal

[CONNECTOR]

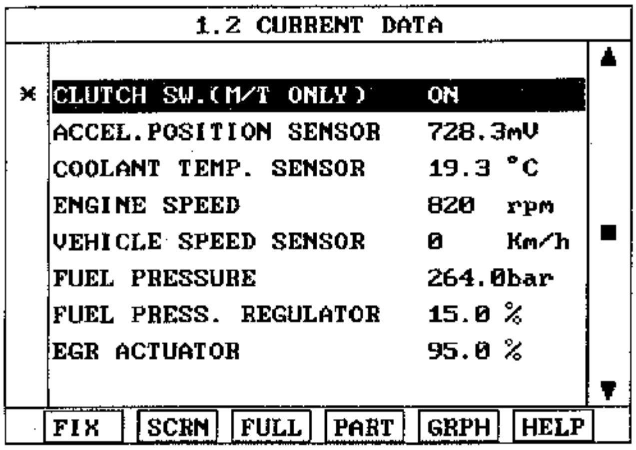
Clutch switch Harness side connector

ECM side terminal



E0704-2

SIGNAL WAVEFORM EFFD5D44



After the ignition switch on, the clutch switch is OFF signal to the ECM.
When depressing the clutch pedal, the clutch switch is ON signal to the ECM.
To check the normal signal from the clutch switch, you should check ON signal current data while depressing the clutch pedal.

E0704-3

MONITOR SCANTOOL DATA E3A8F342

1. Connect scantool to Data Link Cable (DLC).
2. Monitor " Clutch Switch " parameter on the scantool.

FIG 1

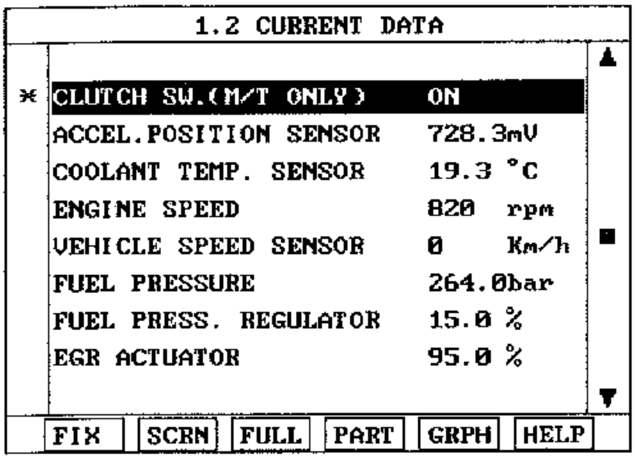


Fig 1) Normal value when depressing clutch pedal.
Is Current data displayed correctly ?

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification vehicle Repair" procedure-.

NO

▶ Go to "W/Harness Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION E8B93A57

1. Many malfunctions in the electrical system are caused by poor harness and terminals.

   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

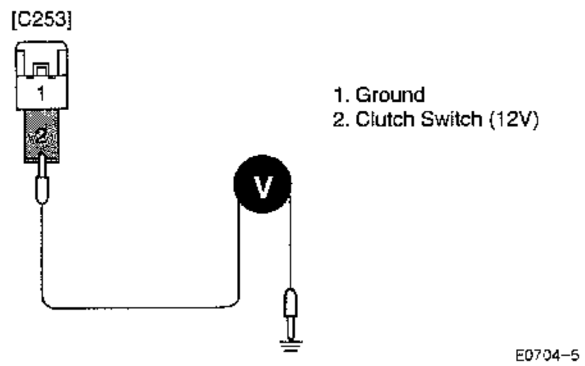
NO

Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION E4BD086E

1. Ignition "OFF" & Engine "OFF".
2. Disconnect Clutch switch connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 2 of the clutch harness connector and chassis ground.

Specification : Approx. 11.5V ~ 12.5V



5. Is the measured voltage within specifications ?

YES

▶ Go to "Ground Circuit Inspection" procedure.

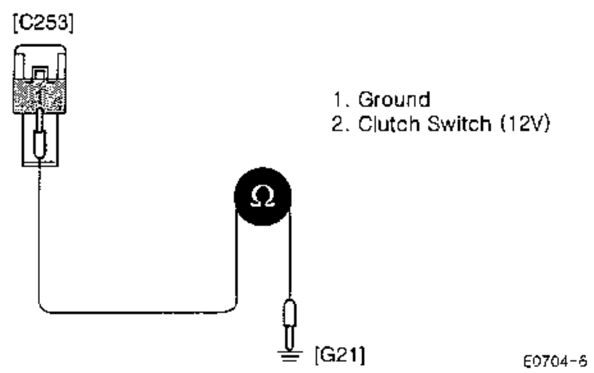
NO

▶ Check for short to battery in control harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure .

GROUND CIRCUIT INSPECTION EE6326DA

1. Ignition "OFF" & Engine "OFF".
2. Disconnect Clutch switch connector.
3. Measure resistance between terminal 1 of clutch switch harness connector and chassis ground G21.

Specification : Approx. below 1Ω



4. Is the measured resistance within specifications ?

YES

▶ Go to "Component Inspection" procedure

NO

▶ Check for open in harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E19ED3EA

1. Check Clutch switch.
   1) Ignition "ON" & Engine "OFF".
   2) Disconnect Clutch switch.
   3) Measure continuity between terminal 1 and 2 of clutch switch connector (To clutch switch connector).

SPECIFICATIONS

Clutch Pedal ON	Clutch Pedal OFF
Continuity (Below 1Ω)	No continuity (O.L Ω)

   4) Is the measured resistance within specifications ?

   YES

   ▶ Substitute with a known-good ECM and check for proper operation.
   If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.

   NO

   ▶ Substitute with a known-good Clutch switch and check for proper operation.
   If the problem is corrected, replace Clutch switch and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E6AEA17D

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle within DTC Enable conditions in General information.
3. Are any DTCs present ?

YES

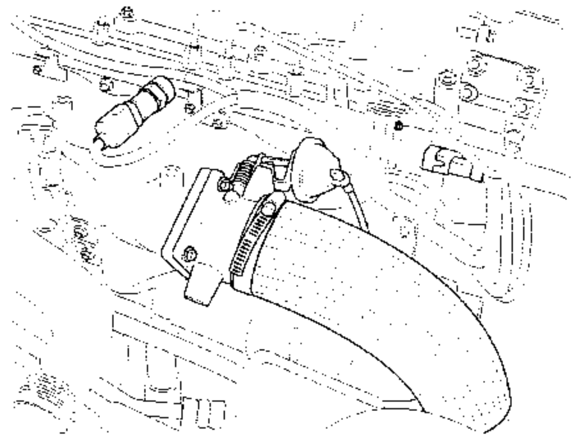
Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

DTC P1182 | FUEL PRESSURE REGULATOR SHORT

COMPONENT LOCATION EBF4EF85



P1182-1

DESCRIPTION E9EF6D9B

GENERAL DESCRIPTION

The FPR (Fuel Pressure Regulator) sets the correct pressure in the rail as a function of engine, loading and maintains it at this level.

If the rail pressure is excessive, the pressure control valve opens and a portion of the fuel returns from the rail to the fuel tank via a collector line.

If the rail pressure is too low, the pressure control valve closes and seals off the high pressurestage from the low pressure stage.

In case of the fuel pressure regulator failure, the engine symptoms will occur the shut down and the starting impossible-.

DTC DESCRIPTION

If the FPR circuit generates threshold value, the ECM judged this as a fault and DTC is set.

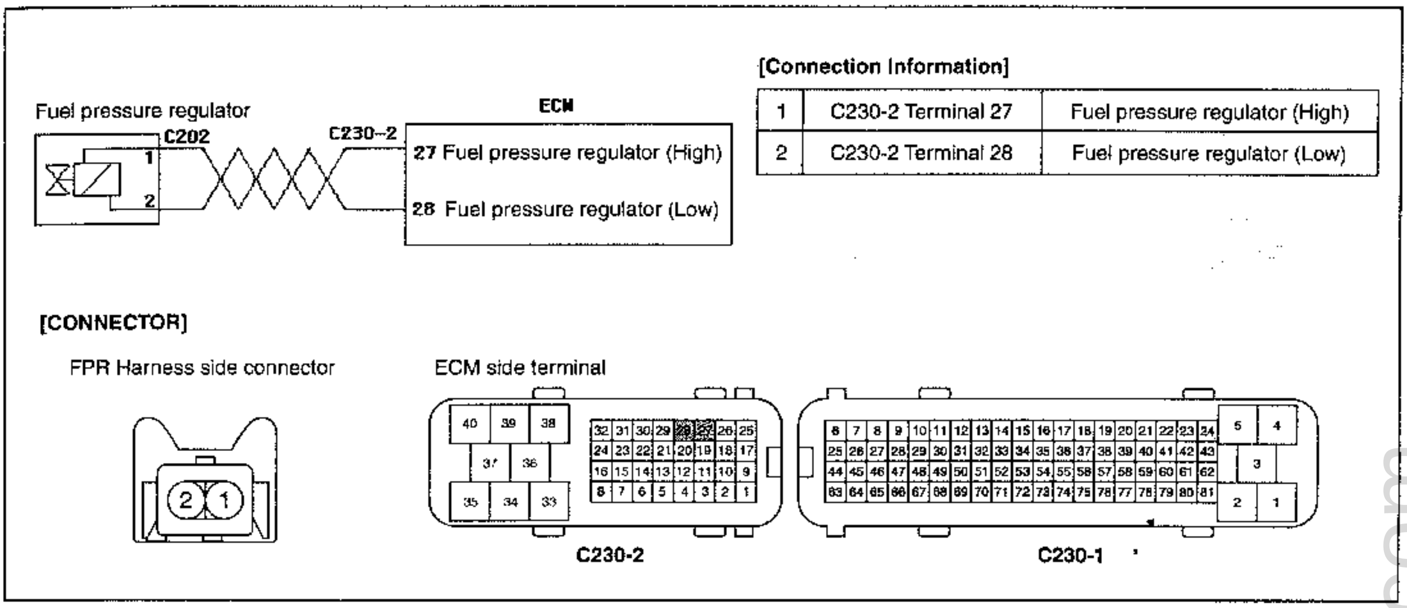
DTC DETECTING CONDITION ECABFC9A

Item	Detecting Condition	Possible Cause
DTC Strategy	• Circuit continuity check	• Shrt to battery in power circuit • Short to battery in control circuit • Faulty FPR • Faulty ECM
Enable Conditions	• Engine run	
Threshold Value	• Short for fuel pressure regulator circuit.	
Diagnostic Time	• 0.3 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• Yes • No • Yes • No	

SPECIFICATION EF184AAD

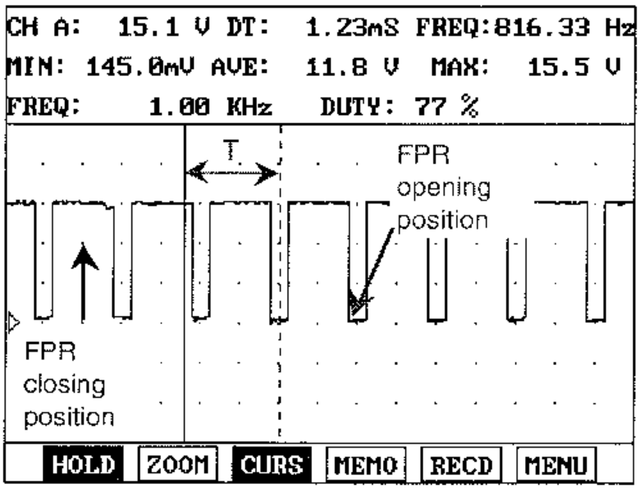
Fuel Pressure Regulator	
Resistance	2.07 ~ 2.53 Ω at 20°C

SCHEMATIC DIAGRAM E419A8A6



E1182-2

SIGNAL WAVEFORM E7D6BD19



This test should be inspected after depressing the HOLD mode at the operating range of FPR.
The cycle time T becomes shorter while idling and the fuel pressure regulator is opening to allow a large amount fuel to returned to the fuel tank.
The cycle time T becomes longer when accelerating and the fuel pressure regulator is closing to allow a small amount fuel to returned to the fuel tank.
The rail pressure regulator is opening and closing by the ECM duty control.

E1182-3

MONITOR SCANTOOL DATA E18063B8

1. Connect scantool to Data Link Cable (DLC).
2. Warm up engine to normal operating temperature.
3. Monitor that " Fuel Pressure and Fuel Pressure Regulator " parameter on the scantool.

FIG 1

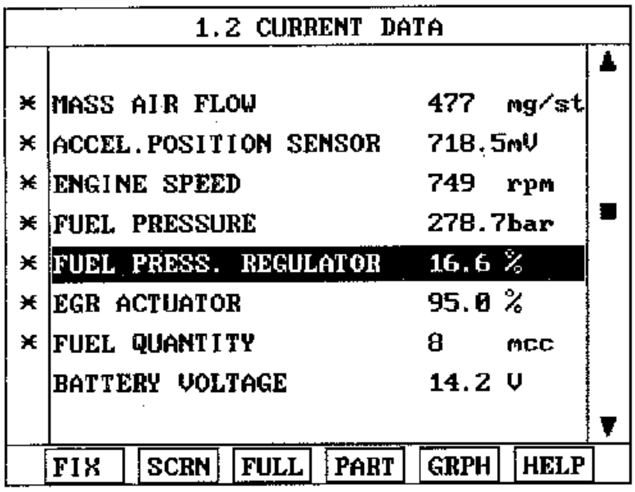


FIG 2

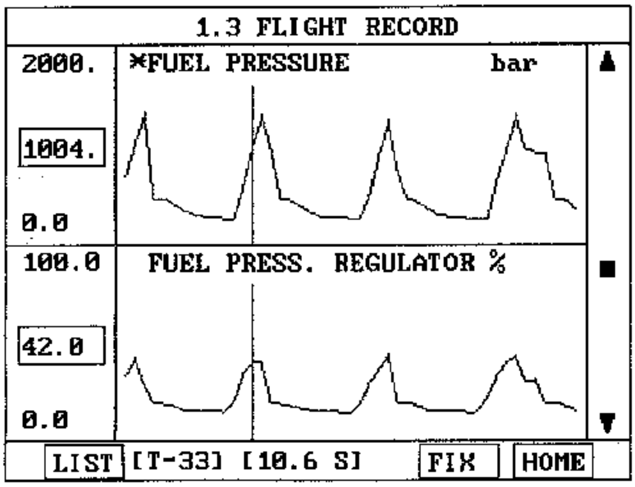


Fig 1) Normal value with fuel pressure and pressure regulator at idle.

Fig 2) Normal value with fuel pressure and engine speed while accelerating and decelerating.

Is the Current data displayed correctly ?

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification vehicle Repair" procedure.

NO

▶ Go to "W/Harness Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION EEF0AA22

1. Many malfunctions in the electrical system are caused by poor harness and terminals.

   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

   YES

   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

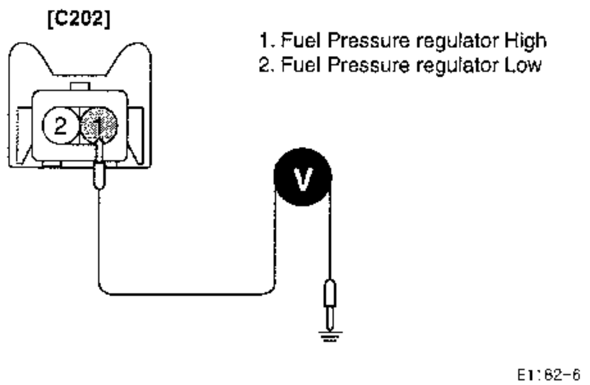
   NO

   Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION E3FEF83C

1. Ignition "OFF" & Engine "OFF".
2. Disconnect Rail Pressure regulator connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 1 of the rail pressure regulator harness connector and chassis ground.

Specification : Approx. 11.5 ~ 13.5V



5. Is the measured voltage within specifications ?

YES

▶ Go to " Control Circuit Inspection" procedure.

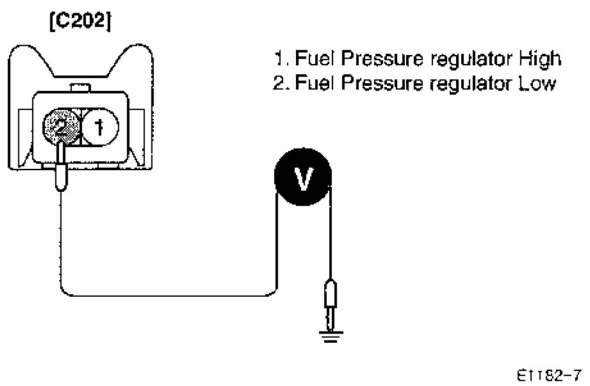
NO

▶ Check for short to battery in the power harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION EA62E5C9

1. Check for short to battery in harness.
   1) Ignition "OFF".
   2) Disconnect Rail pressure regulator connector.
   3) Measure voltage between terminal 2 of rail pressure regulator harness connector and chassis ground.

Specification : Approx. below 1V



4) Is the measured voltage within specifications ?

YES

▶ Go to " Component Inspection " procedure.

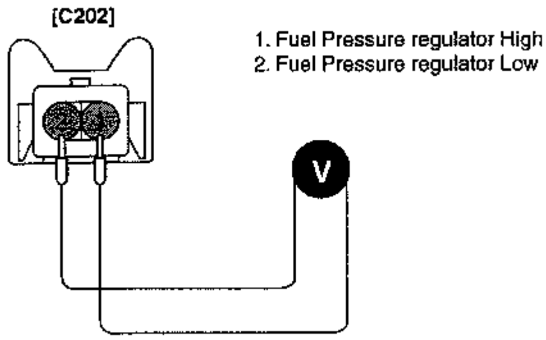
NO

▶ Check for short to battery in ground harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E495ABC8

1. Check Rail Pressure Regulator.
   1) Ignition "OFF".
   2) Disconnect Rail Pressure Regulator.
   3) Measure resistance between terminal 1 and 2 of rail preussure regulator connecor(Component side).

   Specification : 2.07 ~ 2.53 Ω (20°C)



E1182-8

   4) Is the measured resistance within specifications ?

   YES

   ▶ Go to " Check regulating pressure " as below.

   NO

   ▶ Substitute with a known-good rail pressure regulator and check for proper operation.
   If the problem is corrected, replace rail pressure regulator and then go to "Verification of Vehicle Repair" procedure.

2. Check regulating pressure.
   1) Ignition "ON" & Engine "ON".
   2) Monitor signal waveform or graph function of current data by connecting scantool at terminal 2 of Rail preussure regulator.
   3) Ignition "OFF" then Igintion "ON" before Main relay OFF.

   NOTE

   If Main relay OFF, Monitoring current data is impossible. Because Sensor power is cut and communication between scantool and ECM is off.

   This test should be done without any leakage from injector nozzle, return line and high pressure line.

SPECIFICATION

Scopemeter	Scantool
Voltage for rail pressure sensor at idle keep up 1.2V ~ 1.4V. Then, the voltage will drop to 0.7V at the point of Key off. Finally Signal waveform shows that voltage is getting slow down.	Pressure detected by Rail pressure sensor keep up 250bar at idle. Then, Pressure will drop rapidly upto 100bar at the point of key off. Finally, Graph shows that pressure is getting slow down.

4) Does the measured pressure drop rapidly upto 100bar after Key OFF ?

YES

▶ Substitute with a known-good rail pressure regulator and check for proper operation.
If the problem is corrected, replace rail pressure regulator and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Substitute with a known-good ECM and check for proper operation.
If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E906DA5C

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle within DTC Enable conditions in General information.
3. Are any DTCs present ?

YES

Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

DTC P1183 | RAIL PRESSURE REGULATOR - OPEN OR SHORT CIRCUIT

COMPONENT LOCATION E1765FD0

Refer to DTC P1182.

DESCRIPTION E2BC76F8

GENERAL DESCRIPTION

Refer to DTC P1182.

DTC DESCRIPTION

If the FPR circuit generates threshold value, the ECM judged this as a fault and DTC is set.

DTC DETECTING CONDITION E6DEA4A7

Item	Detecting Condition	Possible Cause
DTC Strategy	• Circuit continuity check	• Open or short in power circuit • Open or Short to ground in control circuit • Faulty FPR • Faulty RPS • Faulty ECM
Enable Conditions	• Engine run	
Threshold Value	• Open or Short for fuel pressure regulator circuit	
Diagnostic Time	• 0.3 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• Yes • No • Yes • No	

SPECIFICATION E16F5202

Fuel Pressure Regulator	
Resistance	2.07 ~ 2.53Ω at 20°C

SCHEMATIC DIAGRAM E765BF1B

Refer to DTC P1182.

SIGNAL WAVEFORM EAA2C7BD

Refer to DTC P1182.

MONITOR SCANTOOL DATA EF6C4C2E

Refer to DTC P1182.

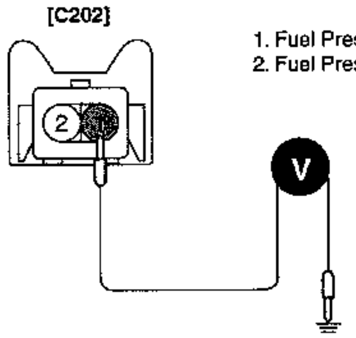
TERMINAL & CONNECTOR INSPECTION ECE39BCB

Refer to DTC P1182.

POWER CIRCUIT INSPECTION EDCCFFC0

1. Ignition "OFF" & Engine "OFF".
2. Disconnect Rail Pressure regulator connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 1 of the rail pressure regulator harness connector and chassis ground.

Specification : Approx. 11.5 ~ 13.5V



E1183-6

5. Is the measured voltage within specifications ?

YES

▶ Go to " Ground Circuit Inspection" procedure.

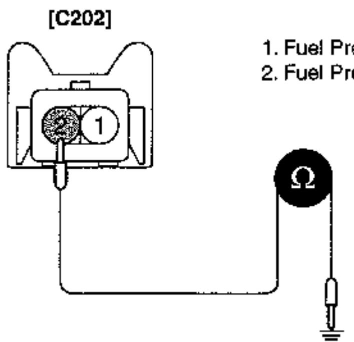
NO

▶ Check for short to battery in the power harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION E2177E4D

1. Check for short to battery in harness.
   1) Ignition "OFF".
   2) Disconnect Rail pressure regulator connector.
   3) Measure voltage between terminal 2 of rail pressure regulator harness connector and chassis ground.

   Specification : Infinite



E1183-7

4) Is the measured voltage within specifications ?

YES

▶ Go to " Check for open in harness " as below.

NO

▶ Check for short to ground in ground harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure .

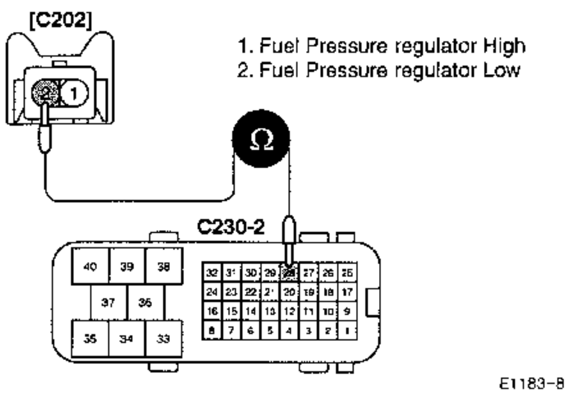
2. Check for open in harness.

1) Ignition "OFF".

2) Disconnect Rail pressure regulator and ECM connector.

3) Measure registance between terminal 2 of rail pressure regulator harness connector and terminal 28 of ECM harness connector.

Specification : Approx. below 1Ω



4) Is the measured resistance within specifications ?

YES

▶ Go to " Component Inspection " procedure.

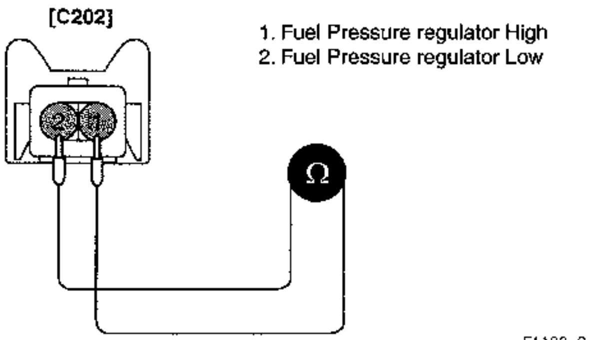
NO

▶ Check for open in ground harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EE41A45D

1. Check Rail Pressure Regulator.
   1) Ignition "OFF".
   2) Disconnect Rail Pressure Regulator.
   3) Measure resistance between terminal 1 and 2 of rail preussure regulator connecor(Component side).

Specification : 2.07 ~ 2.53 Ω (20°C)



   4) Is the measured resistance within specifications ?

YES

▶ Go to " Check regulating pressure " as below.

NO

▶ Substitute with a known-good rail pressure regulator and check for proper operation.
If the problem is corrected, replace rail pressure regulator and then go to "Verification of Vehicle Repair" procedure.

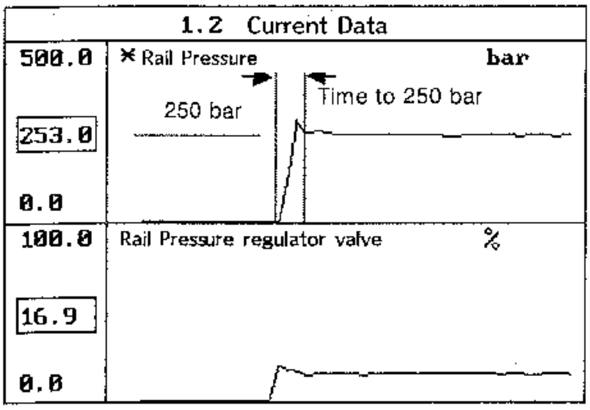
2. Check regulating pressure.
   1) Ignition "ON" & Engine "ON".
   2) Ignition "OFF" then Igintion "ON" before Main relay OFF.
   3) Monitor signal waveform or graph function of current data by connecting scantool at terminal 2 of Rail preussure regulator.

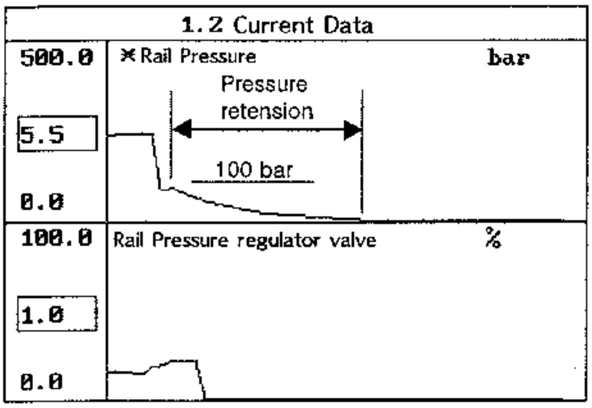
NOTE

If Main relay OFF, Monitoring current data is impossible. Because Sensor power is cut and communication between scantool and ECM is off.

This test should be done without any leakage from injector nozzle, return line and high pressure line.

Time to pressurize upto 250bar is required as shortly as possible after starting but the time to release the pressure to 100 bar after ignition off is required as quickly as passble. However, time to release the pressure from 100bar to 0bar is required as slowly as possible. Refer to picture1 and 2 as below.





Voltage	Pressure
Voltage for rail pressure sensor at idle keep up 1.2V ~ 1.4V. Then, the voltage will drop to 0.7V at the point of Key off. Finally Signal waveform shows that voltage is getting slow down.	Pressure detected by Rail pressure sensor keep up 250bar at idle. Then, Pressure will drop rapidly upto 100bar at the point of key off. Finally, Graph shows that pressure is getting slow down.

4) Is the rail pressure data displayed correctly ?

YES

▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification vehicle Repair" procedure.

NO

▶ Perform Rail Pressure Sensor & Rail Pressure regulator Inspection procedure. For more detail information, refer to DTC P0192,P0193 and P0190 for Rail Pressure sensor and DTC P1182,P1183 and P1184 for Rail Pressure regulator troubleshooting procedure.

Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EBDBD250

Refer to DTC P1182.

DTC P1184 | RAIL PRESSURE REGULATOR - RANGE/ PERFORMANCE

COMPONENT LOCATION EE5FB96A

Refer to DTC P1182.

DESCRIPTION E0FDC7E8

GENERAL DESCRIPTION

Refer to DTC P1182.

DTC DESCRIPTION

If the FPR circuit generates threshold value, the ECM judged this as a fault and DTC is set.

DTC DETECTING CONDITION ECBF84E2

Item	Detecting Condition	Possible Cause
DTC Strategy	• Rationality check	• Faulty Injectors • Faulty FPR • Faulty ECM
Enable Conditions	• After ignition switch OFF in engine running	
Threshold Value	• Engine speed > 500rpm within 1.5 sec.	
Diagnostic Time	• 0 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• Yes • No • Yes • No	

SPECIFICATION EF3AB287

Fuel Pressure Regulator	
Resistance	2.07 ~ 2.53Ω at 20°C

SCHEMATIC DIAGRAM E6370FFE

Refer to DTC P1182.

SIGNAL WAVEFORM EB0AFE9C

Refer to DTC P1182.

MONITOR SCANTOOL DATA E73CBC0B

Refer to DTC P1182.

TERMINAL & CONNECTOR INSPECTION E2C5EBAE

Refer to DTC P1182.

COMPONENT INSPECTION EEC2C9B8

1. Check signal waveform of injector and Rail pressure regulator.
   1) Ignition "ON" & Engine "ON".
   2) Ignition "OFF".
   3) Monitor signal waveform of the injector and rail pressure regulator on the Scantool.

   Specification

   The injectors should not be controlled by ECM when IG Key Off.

   4) Does injector operate even though ignition is OFF ?

   YES

   ▶ Perform Injectors & Rail Pressure regulator Inspection procedure. For more detail information, refer to DTC P0261 to P0272 for Injectors. Repair or replace as necessary and Substitute with a known-good ECM and check for proper operation. If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.

   NO

   ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EA89DE2A

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle within DTC Enable conditions in General information.
3. Are any DTCs present ?

YES

Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

DTC P1185 | MAXIMUM PRESSURE EXCEEDED

COMPONENT LOCATION ED1384BA

Refer to DTC P1182.

DESCRIPTION EA2C4235

GENERAL DESCRIPTION

Fuel pressure monitoring is used to detect the troubles and the fuel leakage in high pressure system.

The ECM determines the rail pressure value as a function of the engine's operating conditions and controls the fuel pressure regulator to ensure that the rail pressure reaches the required value.

Fuel pressure in the fuel line including the pumps and injector are continuously monitored during engine runing.

If the rail pressure is excessive, the fuel pressure regulator opens and a portion of the fuel is returned from the rail to the fuel tank via a collector line. If the rail pressure is too low, the fuel pressure regulator closes.

The fuel pressure regulator closes. the fuel pressure regulator is installed in the tail end of high pressure accumulator

In case of the insufficient fuel supply in the fuel line, the engine symptoms will occur a shut down and a starting impossible.

DTC DESCRIPTION

If the fuel pressure monitoring in engine fuel pressure line generates threshold value, the ECM judged this as a fault and DTC is set.

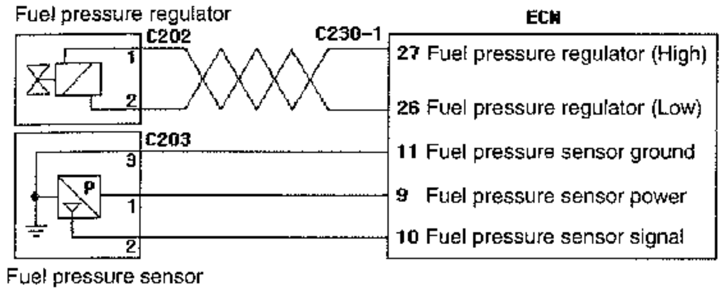
DTC DETECTING CONDITION ED2A0945

Item	Detecting Condition	Possible Cause
DTC Strategy	• Rationality check	• Faulty RPS • Faulty FPR • Faulty ECM
Enable Conditions	• Engine run (above 670 rpm)	
Threshold Value	• Rail pressure > 1450 bar (Maximum pressure exceed)	
Diagnostic Time	• 0.24 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• Yes • Yes • Yes • No	

SPECIFICATION E3A4FEC2

	Rail Pressure	
	Engine idle state	Fully acceleration (100%)
Rail Pressure	220 ~ 320 bar (22 ~ 32 Mpa)	1500 bar (150 Mpa)
Signal Voltage	Below 1.7V	Approx. 4.5V

SCHEMATIC DIAGRAM E7B83CD1



[Connection Information]

C202 Fuel pressure regulator

1	C230-2 Terminal 27	Fuel pressure regulator (High)
2	C230-2 Terminal 26	Fuel pressure regulator (Low)

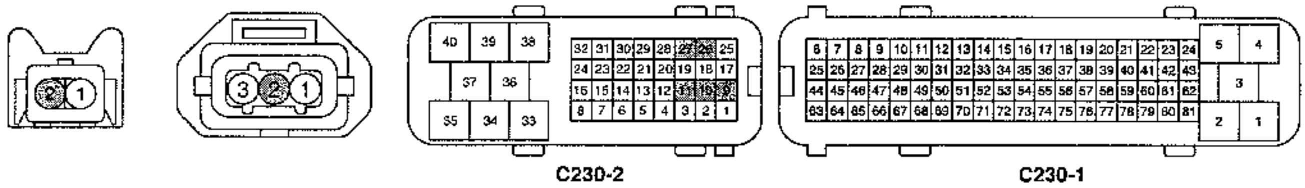
C202 Fuel pressure sensor

1	C230-2 Terminal 9	Fuel pressure sensor power
2	C230-2 Terminal 10	Fuel pressure sensor signal
3	C230-2 Terminal 11	Fuel pressure sensor ground

[CONNECTOR]

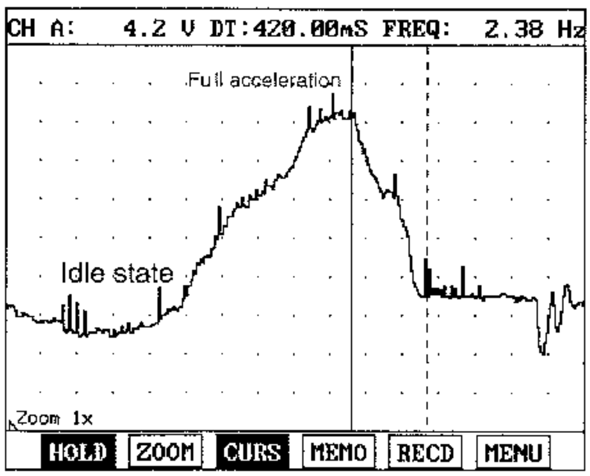
FPR and RPS Harness side connector

ECM side terminal



E1185-2

SIGNAL WAVEFORM E24FEB65



This test should be inspected after depressing the HOLD mode from run after the sudden acceleration.
RPS signal voltage is less than 1V to over 4.5V.
The waveform pattern become increasing upward rapidly when the engine speed increases

E1185-3

MONITOR SCANTOOL DATA E8CD59ED

1. Connect scantool to Data Link Cable (DLC).
2. Warm up engine to normal operating temperature.
3. Monitor that " Fuel Pressure and Fuel Pressure Regulator " parameter on the scantool.

FIG 1

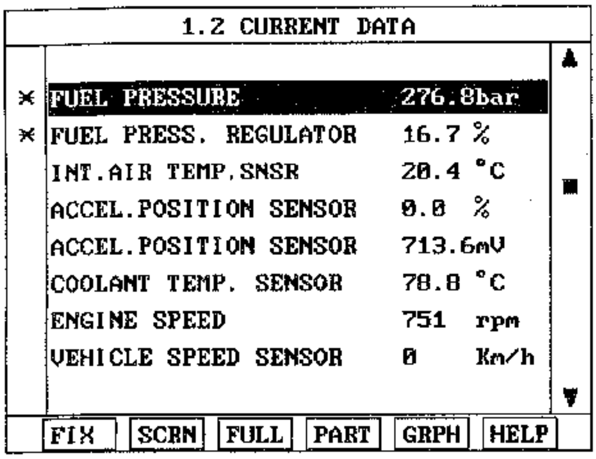


FIG 2

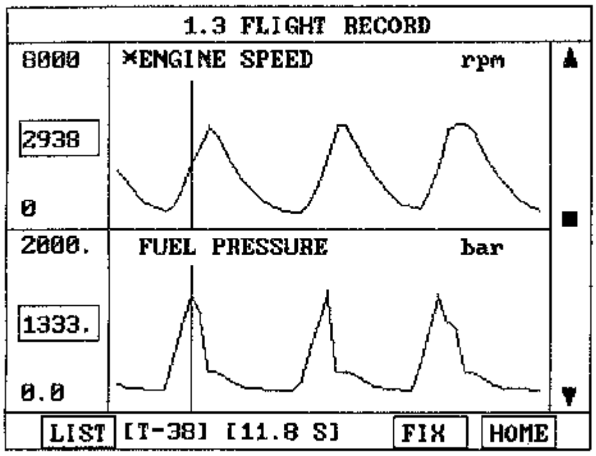


Fig 1) Normal value with fuel pressure and pressure regulator at idle.

Fig 2) Normal value with fuel pressure and engine speed while accelerating and decelerating.

Is the Current data displayed correctly ?

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "W/Harness Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION EB8B6E7F

Refer to DTC P1182.

COMPONENT INSPECTION E50D9C78

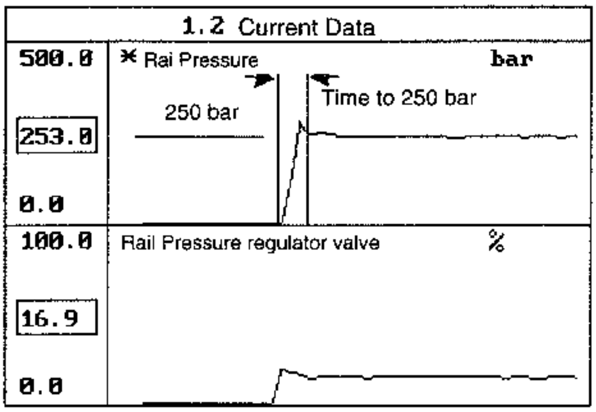
1. Check Rail pressure.
   1) Ignition "ON" & Engine "ON".
   2) Ignition "OFF" then Igintion "ON" before Main relay OFF.
   3) Monitor signal waveform or graph function of current data by connecting scantool at terminal 2 of Rail preuss-ure regulator.

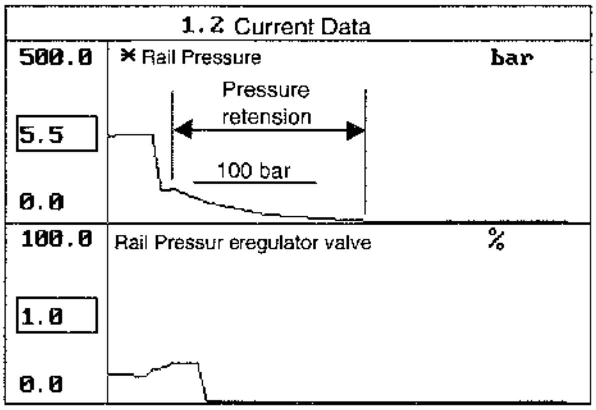
   NOTE

   If Main relay OFF, Monitoring current data is impossible. Because Sensor power is cut and communication between scantool and ECM is off.

   This test should be done without any leakage from injector nozzle, return line and high pressure line.

   Time to pressurize upto 250bar is required as shortly as possible after starting but the time to release the pre-ssure to 100 bar after ignition off is required as quickly as passble. However, time to release the pressure from 100bar to 0bar is required as slowly as possible. Refer to picture1 and 2 as below.





SPECIFICATION

Voltage	Pressure
Voltage from rail pressure sensor at idle is required to keep up with 1.2V ~ 1.4V. Then, the voltage will be drop to 0.7V at the point of Key off. Finally Voltage is getting slowly down	Pressure detected by Rail pressure sensor is required to keep up with 250bar at idle. Then, Pressure will be drop rapidly upto 100bar at the point of key off. Finally, Pressure is getting slowly down

4) Is the rail pressure data displayed correctly ?

YES

▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Perform Rail Pressure Sensor & Rail Pressure regulator Inspection procedure. For more detail information, refer to DTC P0192,P0193 and P0190 for Rail Pressure sensor and DTC P1182,P1183 and P1184 for Rail Pressure regulator troubleshooting procedure.

Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E0B64BEB

Refer to DTC P1182.

DTC P1186 | FUEL PRESSURE MONITORING - MINIMUM PRESSURE AT ENGINE SPEED TOO LOW

COMPONENT LOCATION E7A419F3

Refer to DTC P1182.

DESCRIPTION EA603EFE

GENERAL DESCRIPTION

Refer to DTC P1182.

DTC DESCRIPTION

If the fuel pressure monitoring in engine fuel pressure line generates threshold value, the ECM judged this as a fault and DTC is set.

DTC DETECTING CONDITION EEB13CAF

Item	Detecting Condition	Possible Cause
DTC Strategy	• Rationality check	• Faulty Fuel filter • Faulty Electric fuel pump • Faulty Injector • Faulty FPR • Faulty RPS • Faulty ECM
Enable Conditions	• Case 1: 0 < Engine speed < 2400 rpm • Case 2: Engine speed > 2800 rpm	
Threshold Value	• Case 1: Rail pressure < 120 bar • Case 2: Rail pressure < 200 bar (Governor deviation at the high engine speed)	
Diagnostic Time	• 0.0012 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• Yes • Yes • Yes • No	

SPECIFICATION EB32911C

Rail Pressure		
	Engine idle state	Fully acceleration (100%)
Rail Pressure	220 ~ 320 bar (22 ~ 32 Mpa)	1500 bar (150 Mpa)
Signal Voltage	Below 1.7V	Approx. 4.5V

SCHEMATIC DIAGRAM ED9BF911

Refer to DTC P1182.

SIGNAL WAVEFORM E2E67EB7

Refer to DTC P1182.

MONITOR SCANTOOL DATA EDAFAC26

Refer to DTC P1182.

TERMINAL & CONNECTOR INSPECTION EAAA5BC1

Refer to DTC P1182.

COMPONENT INSPECTION E7A7B9CA

Refer to DTC P1182.

VERIFICATION OF VEHICLE REPAIR E05CCE44

Refer to DTC P1182.

DTC P1187 | FUEL PRESSURE MONITORING - REGULATOR VALVE STICK

COMPONENT LOCATION E81DC456

Refer to DTC P1182.

DESCRIPTION E32D91DB

GENERAL DESCRIPTION

Refer to DTC P1182.

DTC DESCRIPTION

If the fuel pressure monitoring in engine fuel pressure line generates threshold value, the ECM judged this as a fault and DTC is set.

DTC DETECTING CONDITION E5EDF968

Item	Detecting Condition	Possible Cause
DTC Strategy	• Rationality check	• Faulty FPR • Faulty RPS • Faulty ECM
Enable Conditions	• Engine run (above 670 rpm)	
Threshold Value	• Fuel rail regulator duty ratio < 10% and rail pressure > 250 bar as against actual target rail pressure value.	
Diagnostic Time	• 1 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• Yes • Yes • Yes • No	

SPECIFICATION EBD986ED

Rail Pressure		
	Engine idle state	Fully acceleration (100%)
Rail Pressure	220 ~ 320 bar (22 ~ 32 Mpa)	1500 bar (150 Mpa)
Signal Voltage	Below 1.7V	Approx. 4.5V

SCHEMATIC DIAGRAM EEF3BCEC

Refer to DTC P1182.

SIGNAL WAVEFORM E5EC7CD5

Refer to DTC P1182.

MONITOR SCANTOOL DATA EBE1C2ED

Refer to DTC P1182.

TERMINAL & CONNECTOR INSPECTION E418DF7F

Refer to DTC P1182.

COMPONENT INSPECTION EF4297EF

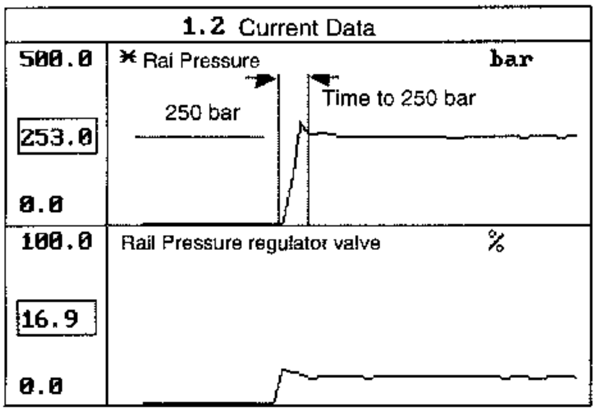
1. Check Rail pressure.
   1) Ignition "ON" & Engine "ON".
   2) Ignition "OFF" then Igintion "ON" before Main relay OFF.
   3) Monitor signal waveform or graph function of current data by connecting scantool at terminal 2 of Rail preuss-ure regulator.

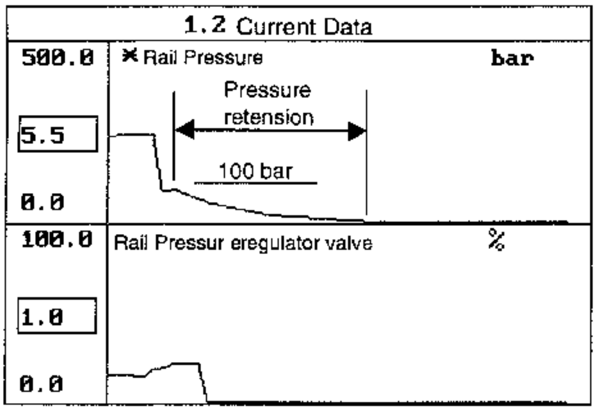
   NOTE

   If Main relay OFF, Monitoring current data is impossible. Because Sensor power is cut and communication between scantool and ECM is off.

   This test should be done without any leakage from injector nozzle, return line and high pressure line.

   Time to pressurize upto 250bar is required as shortly as possible after starting but the time to release the pressure to 100 bar after ignition off is required as quickly as passble. However, time to release the pressure from 100bar to 0bar is required as slowly as possible. Refer to picture1 and 2 as below.





SPECIFICATION

Voltage	Pressure
Voltage from rail pressure sensor at idle is required to keep up with 1.2V ~ 1.4V. Then, the voltage will be drop to 0.7V at the point of Key off. Finally Voltage is getting slowly down	Pressure detected by Rail pressure sensor is required to keep up with 250bar at idle. Then, Pressure will be drop rapidly upto 100bar at the point of key off. Finally, Pressure is getting slowly down

4) Is the rail pressure data displayed correctly ?

YES

▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Perform Rail Pressure Sensor & Rail Pressure regulator Inspection procedure. For more detail information, refer to DTC P0192,P0193 and P0190 for Rail Pressure sensor and DTC P1182,P1183 and P1184 for Rail Pressure regulator troubleshooting procedure.

Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR ECD2CC8B

Refer to DTC P1182.

DTC P1188 | FUEL PRESSURE MONITORING - LEAKAGE

COMPONENT LOCATION EA5FA293

Refer to DTC P1182.

DESCRIPTION EEB30FAA

GENERAL DESCRIPTION

Refer to DTC P1182.

DTC DESCRIPTION

If the fuel pressure monitoring in engine fuel pressure line generates threshold value, the ECM judged this as a fault and DTC is set.

DTC DETECTING CONDITION E1D7CEAF

Item	Detecting Condition	Possible Cause
DTC Strategy	• Rationality check	• Faulty Fuel filter • Faulty Electric fuel pump • Faulty Injector • Faulty FPR • Faulty ECM
Enable Conditions	• Engine run (above 670 rpm)	
Threshold Value	• Fuel rail regulator duty ratio 79% and rail pressure < 250 bar as against actual target rail pressure value (Fuel pessure regulator leakage).	
Diagnostic Time	• 1 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• Yes • Yes • Yes • No	

SPECIFICATION E66EFC13

	Rail Pressure	
	Engine idle state	Fully acceleration (100%)
Rail Pressure	220 ~ 320 bar (22 ~ 32 Mpa)	1500 bar (150 Mpa)
Signal Voltage	Below 1.7V	Approx. 4.5V

SCHEMATIC DIAGRAM E2DDD184

Refer to DTC P1182.

SIGNAL WAVEFORM ED0BEF27

Refer to DTC P1182.

MONITOR SCANTOOL DATA E93D0E36

Refer to DTC P1182.

TERMINAL & CONNECTOR INSPECTION E4C5DCC1

1. Many malfunctions in the electrical system are caused by poor harness and terminals.

   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to " Component Inspection " procedure.

COMPONENT INSPECTION EAC322CB

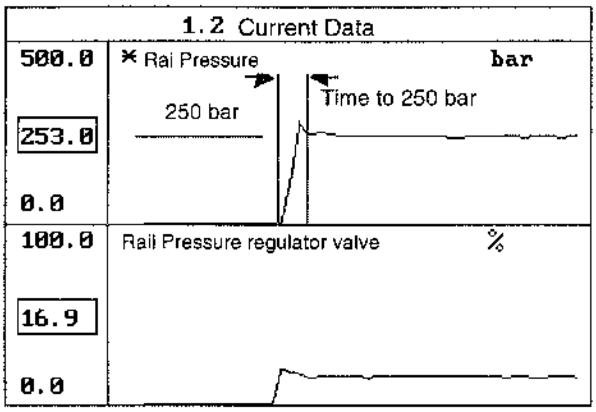
1. Check Rail pressure.
   1) Ignition "ON" & Engine "ON".
   2) Ignition "OFF" then Igintion "ON" before Main relay OFF.
   3) Monitor signal waveform or graph function of current data by connecting scantool at terminal 2 of Rail preussure regulator.

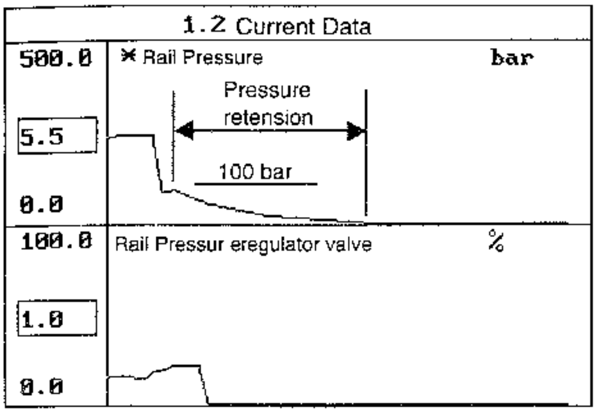
   NOTE

   If Main relay OFF, Monitoring current data is impossible. Because Sensor power is cut and communication between scantool and ECM is off.

   This test should be done without any leakage from injector nozzle, return line and high pressure line.

   Time to pressurize upto 250bar is required as shortly as possible after starting but the time to release the pressure to 100 bar after ignition off is required as quickly as passble. However, time to release the pressure from 100bar to 0bar is required as slowly as possible. Refer to picture1 and 2 as below.





SPECIFICATION

Voltage	Pressure
Voltage from rail pressure sensor at idle is required to keep up with 1.2V ~ 1.4V. Then, the voltage will be drop to 0.7V at the point of Key off. Finally Voltage is getting slowly down	Pressure detected by Rail pressure sensor is required to keep up with 250bar at idle. Then, Pressure will be drop rapidly upto 100bar at the point of key off. Finally, Pressure is getting slowly down.

4) Is the rail pressure data displayed correctly ?

YES

▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Perform Fuel Pump relay, Injectors, Rail Pressure Sensor and Rail Pressure regulator Inspection procedure. For more detail information, refer to DTC P0232 and P0231 for Fuel pump relay, P0261~0272 for injectors P0192,P0193 and P0190 for Rail Pressure sensor and DTC P1182,P1183 and P1184 for Rail Pressure regulator troubleshooting procedure.

Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E78EA9D8

Refer to DTC P1182.

DTC P1189 | FUEL PRESSURE MONITORING - GOVERNOR DEVIATION AT ENGINE SPEED TOO HIGH

COMPONENT LOCATION EBCA4ED7

Refer to DTC P1182.

DESCRIPTION EE61F46B

GENERAL DESCRIPTION

Refer to DTC P1182.

DTC DESCRIPTION

If the fuel pressure monitoring in engine fuel pressure line generates threshold value, the ECM judged this as a fault and DTC is set.

DTC DETECTING CONDITION EF2A9269

Item	Detecting Condition	Possible Cause
DTC Strategy	• Rationality check	• Faulty Fuel filter • Faulty Electric fuel pump • Faulty Injector • Faulty High pressure pump • Faulty FPR • Faulty ECM
Enable Conditions	• Engine run (above 670 rpm)	
Threshold Value	• Rail pressure < 250 bar as against actual target rail pressure value (Minimum pressure at the low engine speed).	
Diagnostic Time	• 0.002 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• Yes • Yes • Yes • No	

SPECIFICATION E6A589ED

Rail Pressure		
	Engine idle state	Fully acceleration (100%)
Rail Pressure	220 ~ 320 bar (22 ~ 32 Mpa)	1500 bar (150 Mpa)
Signal Voltage	Below 1.7V	Approx. 4.5V

SCHEMATIC DIAGRAM E9B81E8C

Refer to DTC P1182.

SIGNAL WAVEFORM EC4F6CFF

Refer to DTC P1182.

MONITOR SCANTOOL DATA E1CD32F9

Refer to DTC P1182.

TERMINAL & CONNECTOR INSPECTION EC8C4F02

1. Many malfunctions in the electrical system are caused by poor harness and terminals.

   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to " Component Inspection " procedure.

COMPONENT INSPECTION E24C5614

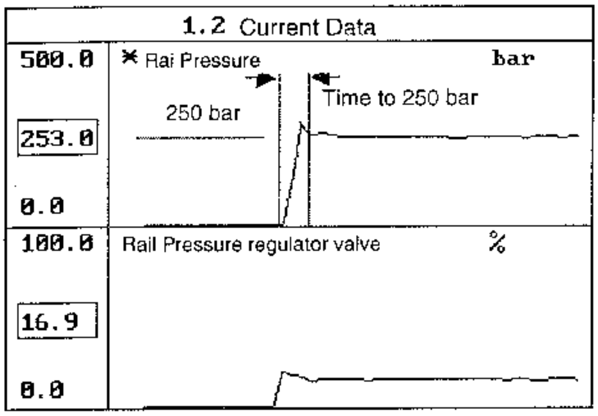
1. Check Rail pressure.
   1) Ignition "ON" & Engine "ON".
   2) Ignition "OFF" then Igintion "ON" before Main relay OFF.
   3) Monitor signal waveform or graph function of current data by connecting scantool at terminal 2 of Rail preuss-ure regulator.

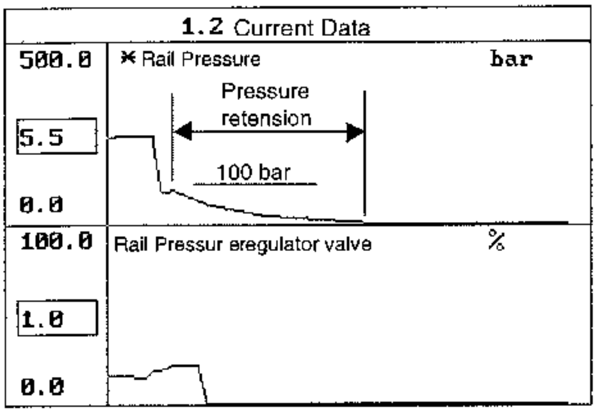
NOTE

If Main relay OFF, Monitoring current data is impossible. Because Sensor power is cut and communication between scantool and ECM is off.

This test should be done without any leakage from injector nozzle, return line and high pressure line.

Time to pressurize upto 250bar is required as shortly as possible after starting but the time to release the pressure to 100 bar after ignition off is required as quickly as passble. However, time to release the pressure from 100bar to 0bar is required as slowly as possible. Refer to picture1 and 2 as below.





SPECIFICATION

Voltage	Pressure
Voltage from rail pressure sensor at idle is required to keep up with 1.2V ~ 1.4V. Then, the voltage will be drop to 0.7V at the point of Key off. Finally Voltage is getting slowly down	Pressure detected by Rail pressure sensor is required to keep up with 250bar at idle. Then, Pressure will be drop rapidly upto 100bar at the point of key off. Finally, Pressure is getting slowly down.

4) Is the rail pressure data displayed correctly ?

YES

▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Perform Fuel Pump relay, Injectors, Rail Pressure Sensor and Rail Pressure regulator Inspection procedure. For more detail information, refer to DTC P0232 and P0231 for Fuel pump relay, P0261~0272 for injectors P0192,P0193 and P0190 for Rail Pressure sensor and DTC P1182,P1183 and P1184 for Rail Pressure regulator troubleshooting procedure.

Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

E7DC04B9

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle within DTC Enable conditions in General information.
3. Are any DTCs present ?

YES

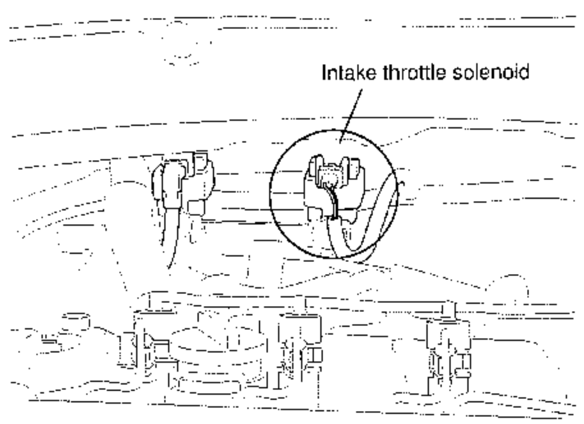
Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

DTC P1190 | INTAKE THROTTLE ACTUATOR - OPEN OR SHORT CIRCUIT

COMPONENT LOCATION E9A4A22E



KFQE:901

DESCRIPTION E6FF89B3

GENERAL DESCRIPTION

By actuating of flaps in the intake passage the passage at the inlet valve of the cylinder can be narrowed.

This reduces the air flow. The flaps in the intake passage are controlled by the intake throttle actuator.

Calculation of the duty cycle for the inlet passage shut-off can switched on and off by the function switch of the inlet passage shut off.

If the engine speed and the demand quantity + low idle governor exceed certain thresholds, also the MAFS signal must be above a threshold. If this is not the case, the error "flap blocked closed" is recognized.

If the engine speed and the control duty cycle exceed certain thresholds, the digital switch of the inlet passage shut off must be actuated. If it is, the error flap blocked open is recognized.

In case of the throttle actuator stuck, the engine symptoms will occur a running engine stall and a starting impossible.

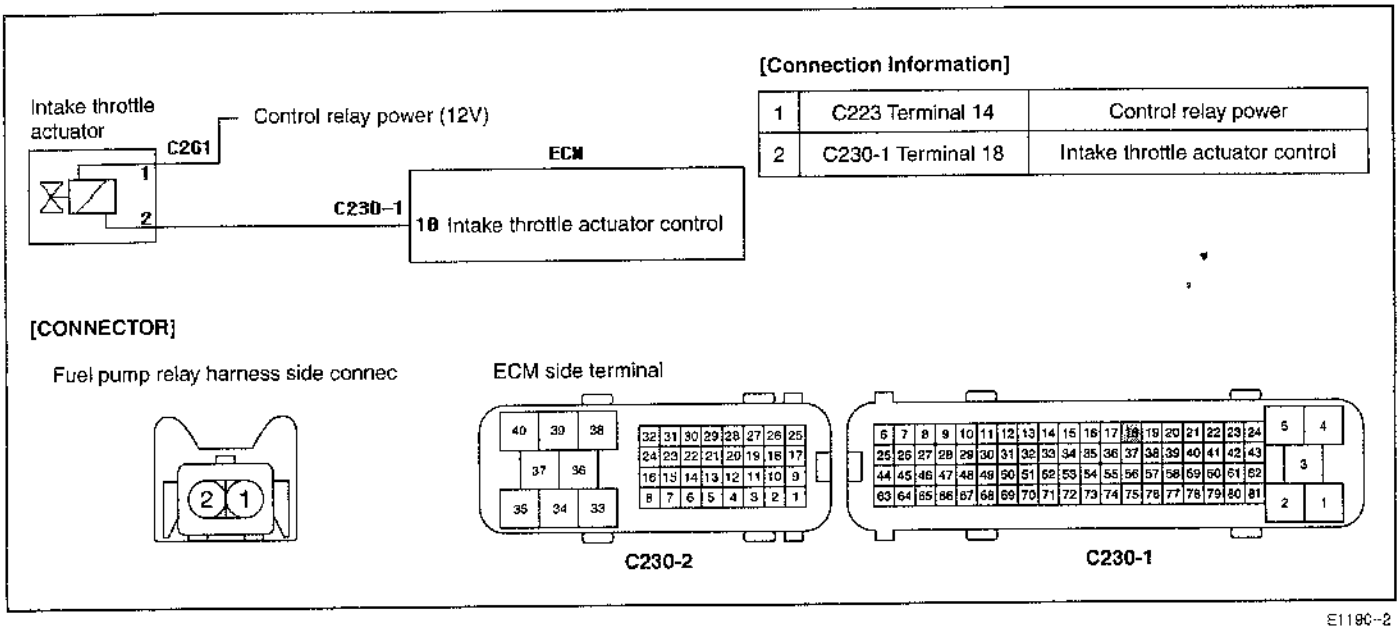
DTC DESCRIPTION

If the signal generates threshold value, the ECM judged this as a fault and DTC is set.

DTC DETECTING CONDITION EAB2BEC2

Item	Detecting Condition	Possible Cause
DTC Strategy	• Circuit continuity check	• Open or short in power circuit • Open or short in control circuit • Faulty throttle actuator • Faulty ECM
Enable Conditions	• Engine run	
Threshold Value	• Open or short for relay control circuit	
Diagnostic Time	• 0.48 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• No • No • No • Yes	

SCHEMATIC DIAGRAM ED32744E

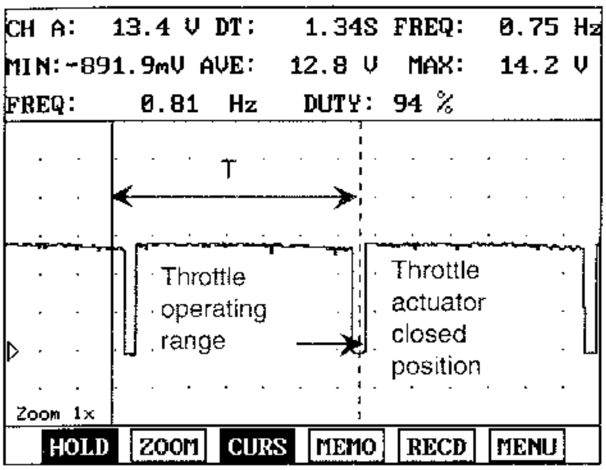


[Connection Information]

1	C223 Terminal 14	Control relay power
2	C230-1 Terminal 18	Intake throttle actuator control

E1190-2

SIGNAL WAVEFORM EA2ACB47



This test should be inspected after depressing the HOLD mode at the operating range of the throttle actuator.
The time T becomes shorter when the throttle actuaator is opened increasingly.
This waveform is funtion to diagnosis the intake throttle actuator rather than operate, or so the intake throttle actuator is not operated actually at engine running.

EL190: 3

MONITOR SCANTOOL DATA E4E6D95A

1. Connect scantool to Data Link Cable (DLC).
2. Warm up engine to normal operating temperature.
3. Monitor that " Intake Throttle Actuator " parameter on the scantool.

FIG 1

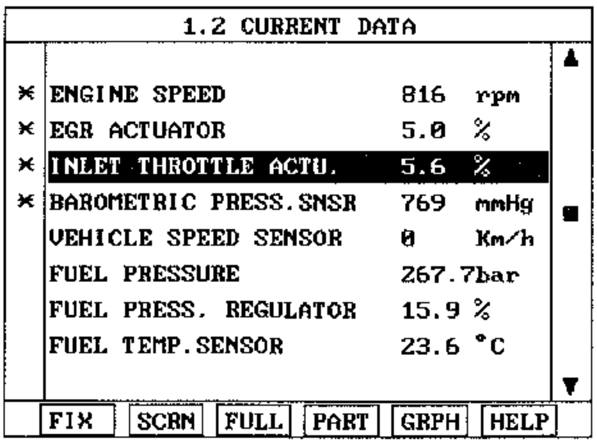


FIG 2

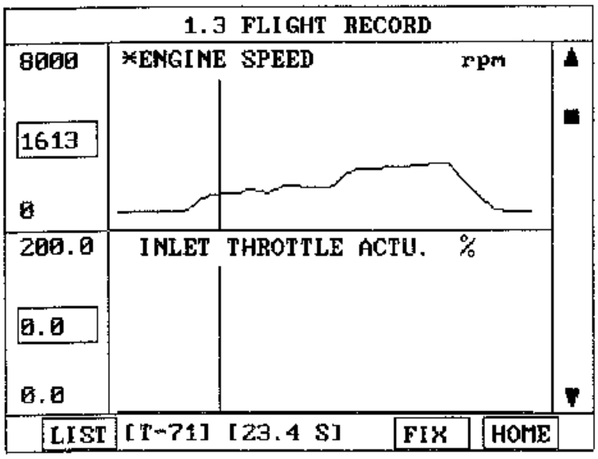


Fig 1) Normal value with intake throttle actuator at idle.

Fig 2) Normal value with intake throttle actuator and engine speed while accelerating and decelerating.

Is the Current data displayed correctly ?

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "W/Harness Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION EFAAFE5F

1. Many malfunctions in the electrical system are caused by poor harness and terminals.

   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

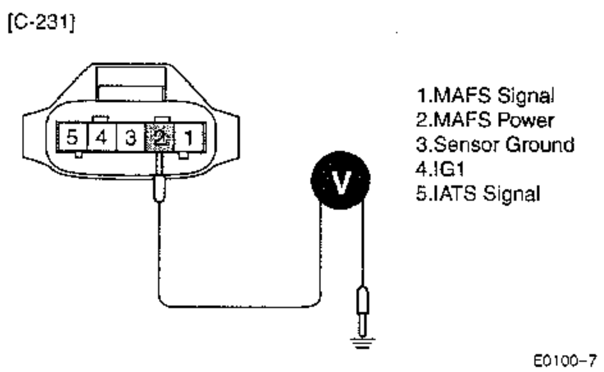
NO

Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION ECAACDDC

1. Check for short in harness
   1) Ignition "OFF".
   2) Disconnect MAF sensor connector.
   3) Ignition "ON" & Engine "OFF".
   4) Measure voltage between terminal "2" of the sensor harness connector and chassis ground.

Specification : 4.8V ~ 5.1V



   5) Is the measured voltage within specifications ?

YES

▶ Go to "Component Inspection" procedure.

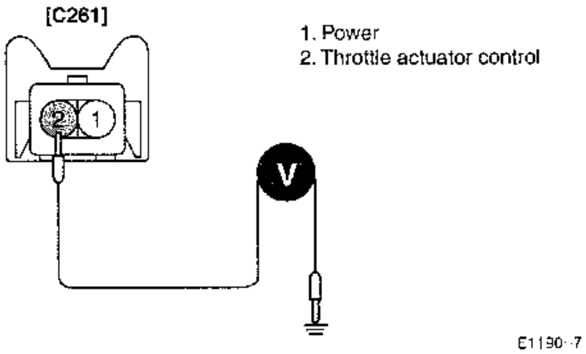
NO

▶ Check for short to battery or ground in the MAFS power harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION E9A8A2E4

1. Check for short to battery in harness.
   1) Ignition "OFF".
   2) Disconnect throttle acutator connector.
   3) Ignition " ON" & Engine " OFF".
   4) Measure voltage between terminal 2 of the throttle actuator harness connector and chassis ground.

   Specification : Approx. below 1V



   5) Is the measured voltage within specificaitons ?

   YES

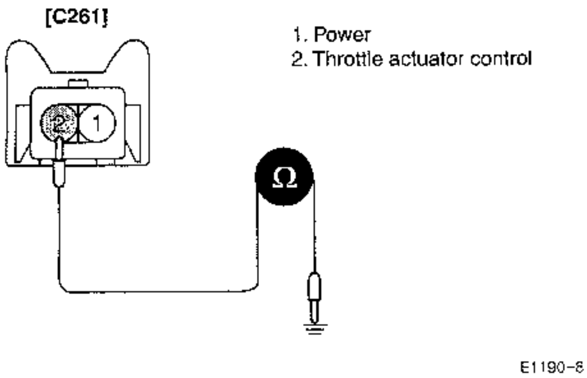
   ▶ Go to " Check for short to ground in harness " as below.

   NO

   ▶ Check for short to battery in control harness.
   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to ground in harness.
   1) Ignition "OFF".
   2) Disconnect throttle acutator connector.
   3) Measure voltage between terminal 2 of the throttle actuator harness connector and chassis ground.

   Specification : Infinite



4) Is the measured resistance within specifications ?

YES

▶ Go to " Check for open in harness " as below.

NO

▶ Check for short to ground in control harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure .

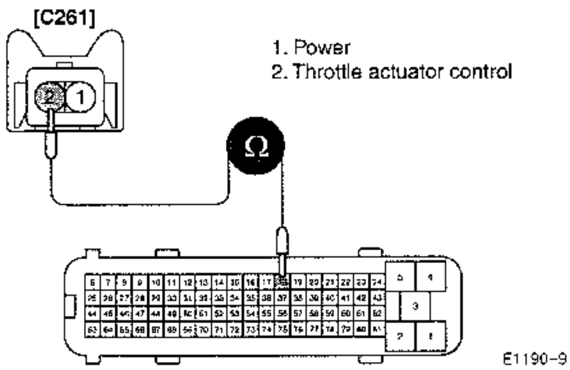
3. Check for open in harness.

1) Ignition "OFF" & Engine "OFF".

2) Disconnect Throttle actuator and ECM connector.

3) Measure resistance between terminal 2 of the sensor harness connector and ECM(37) harenss connector.

Specification : Approx. below 1Ω



4) Is the measued resistance within specifications ?

YES

▶ Go to "Component Inspection" procedure.

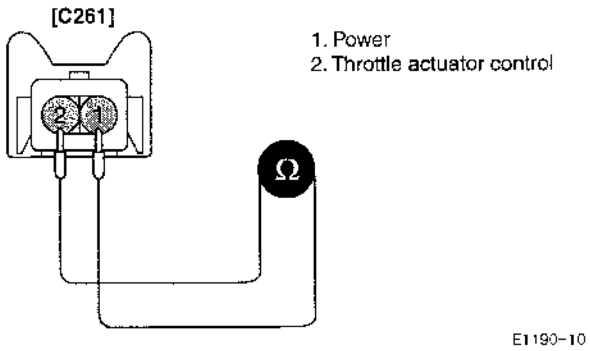
NO

▶ Check for open in harness.
Repair as necessary and go to "Verification of of Vehicle Repair" procedure .

COMPONENT INSPECTION EE8B9971

1. Check Throttle actuator.
   1) Ignition "OFF".
   2) Disconnect Throttle actuator.
   3) Measure resistance between terminal 1 and 2 of throttle actuator connecor(Component side).

Specification : 14 ~ 17 Ω (20°C)



   4) Is the measued resistance within specifications ?

YES

▶ Go to "Check Throttle Actuator Operation" as below.

NO

▶ Substitute with a known-good throttle actuator and check for proper operation.
If the problem is corrected, replace throttle actuator and then go to "Verification of Vehicle Repair" procedure

2. Check Throttle actuator Operation.
   1) Ignition "ON" & Engine "ON".
   2) Check that operating duty of throttle actuator is around 5% at idle.
   3) Check that vaccum is felt after disconnecting vaccum hose from throttle actuator valve.
   4) Check that vaccum is felt at the moment after ignition off.

SPECIFICATION

Operating Duty of Throttle actuator : 5%	Operating Duty of Throttle actuator : 95%
No vaccum (Close valve)	Vaccum (Open valve)

   5) Is the vaccum felt according to the operating duty of throttle actuator ?

YES

▶ Substitute with a known-good ECM and check for proper operation.
If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure .

VERIFICATION OF VEHICLE REPAIR E01DB7F0

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle within DTC Enable conditions in General information.
3. Are any DTCs present ?

YES

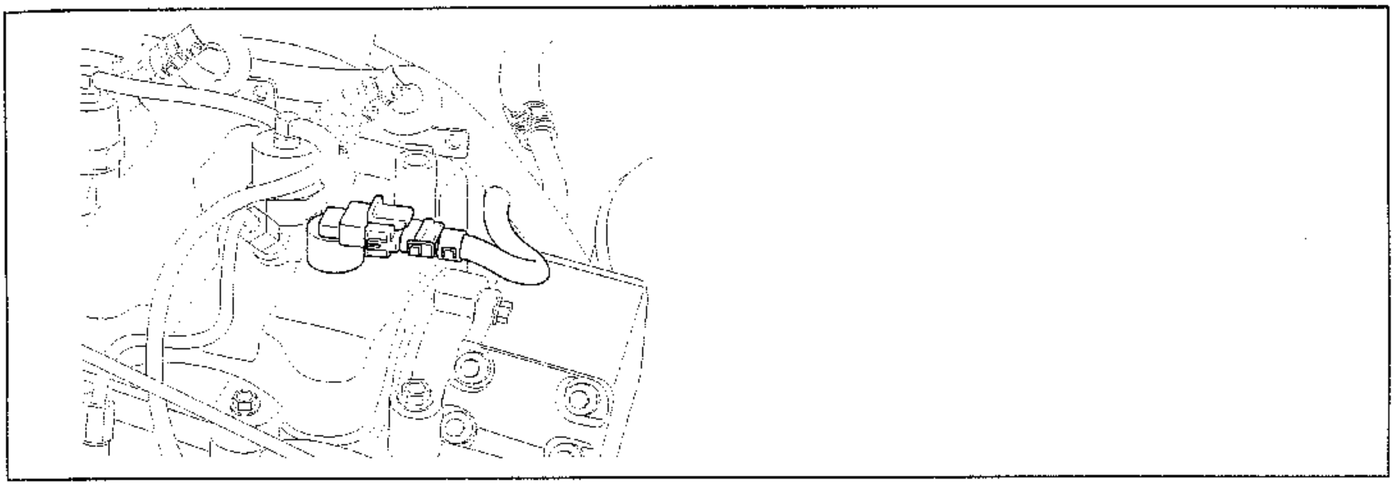
Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

DTC P1300 | CAM/ENGINE SPEED SENSOR - SYNCHRONIZATION ERROR (CKP/CMP PLAUSIBILITY)

COMPONENT LOCATION E52DE494



E1300-1

DESCRIPTION EB130D9D

GENERAL DESCRIPTION

The crankshaft angular sensor detects and counts the teeth on the crankshaft and provides ECM with the information on the current position of crank angle and cylinder. This signal is fed to ECM to be used to determine the engine speed and adjust the fuel injection timing. The camshaft position sensor detects the teeth target wheel and provides ECM with the information on the current position of piston and cylinder.

This signal is fed to ECM to be used to determine the sequence of fuel injection.

In case of the the crankshaft angular sensor or the camshaft position sensor failure, the engine symptoms will occur a running engine stall, starting impossible and rough idle with noise.

DTC DESCRIPTION

If the CMP signal and the CKP signal is out of allowed limits, the ECM judged this as a fault and DTC is set.

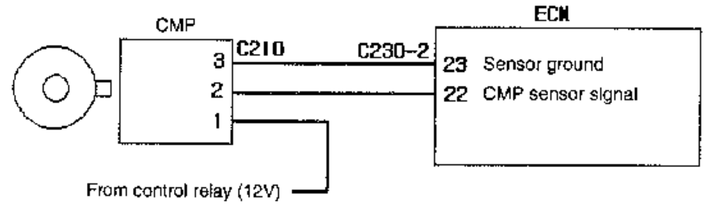
DTC DETECTING CONDITION EDD0D9A8

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal check	• Open or short in power circuit • Short to ground in signal circuit • Open in ground circuit • Faulty Dowel Pin • Faulty CMP • Faulty CKP • Faulty ECM
Enable Conditions	• Engine run	
Threshold Value	• CMP signal and CKP signal are abnormal correlatively	
Diagnostic Time	• 0 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• No • No • Yes • No	

SPECIFICATION EFF39EA7

CKP	
Resistance	860 ± 10% Ω at 20°C

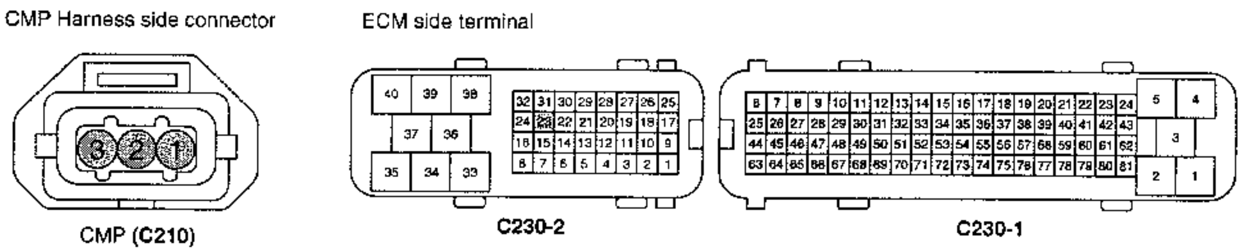
SCHEMATIC DIAGRAM EC04D4AB



[Connection Information]

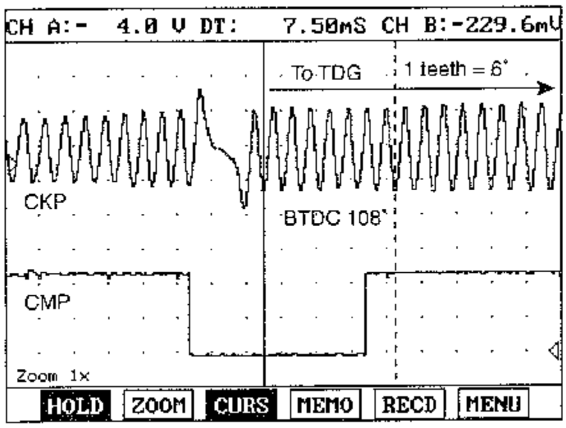
1	C223 Terminal 17	Control relay power
2	C230-2 Terminal 22	CMP sensor signal
3	C230-2 Terminal 23	CMP sensor ground

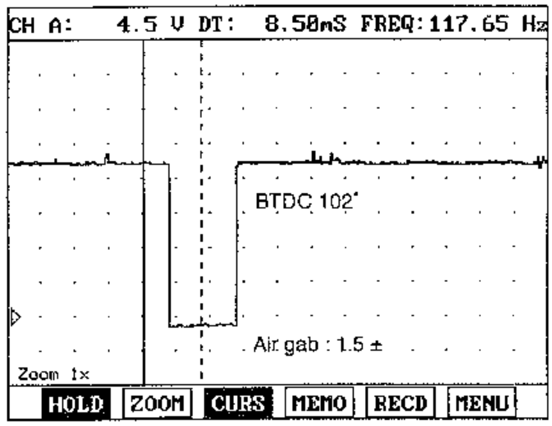
[CONNECTOR]



E1300-2

SIGNAL WAVEFORM EA9A1BBB





The given data is the normal waveform of the crankshaft position sensor (CKPS) and the Camshaft position sensor (CMPS).
The CKP sinusoidal signal generates continuosly except 2 missing teeth.
but the CMP squre waveform signal is output even when the CMP sensor meets the dowel pin of camshaft.
If the waveform pattern becomes distorted or generated no signal while cranking or idling, replace the CKP or the CMP.

E1300-3

MONITOR SCANTOOL DATA E775AF3F

1. Connect scantool to Data Link Cable (DLC).
2. Warm up engine to normal operating temperature.
3. Monitor "Acceleration Position Sensor & Engine Speed" parameter on the scantool .

FIG 1

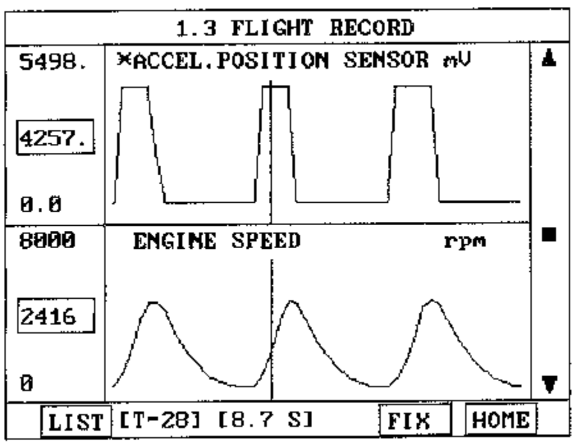


Fig 1) APS signal and engine speed increase when depressing accel pedal.

Is the Current data displayed correctly ?

YES

Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "W/Harness Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION E109C73E

1. Many malfunctions in the electrical system are caused by poor harness and terminals..

   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

   YES

   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

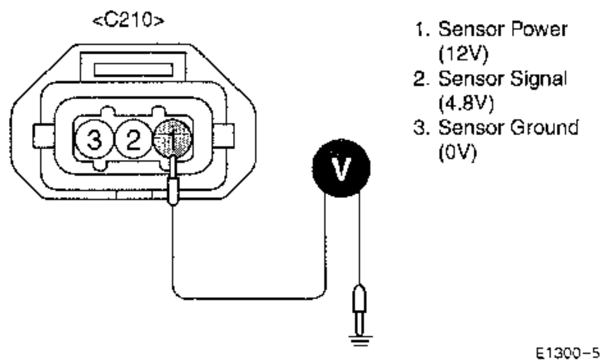
   NO

   Go to "Power Circuit Inspection" procedure.

POWER CIRCUIT INSPECTION EDA9FCCB

1. Ignition "OFF" & Engine "OFF".
2. Disconnect CMP sensor connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 1 of the sensor harness connector and chassis ground.

Specification : Approx. B+



5. Is the measured voltage within specifications ?

YES

▶ Go to "Signal Circuit Inspection" procedure.

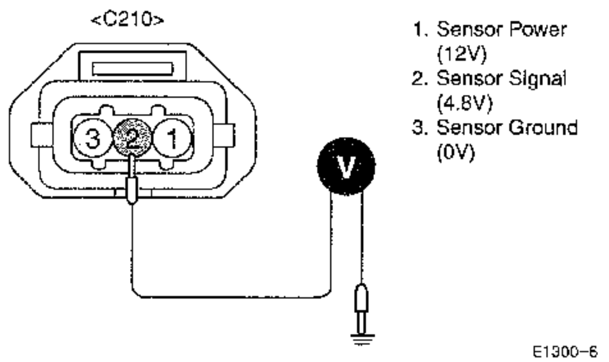
NO

▶ Check for open or short in power harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION E687EC3A

1. Ignition "OFF" & Engine "OFF".
2. Disconnect CMP sensor connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 2 of the sensor harness connector and chassis ground.

Specification : Approx. 5V



5. Is the measured voltage within specifications ?

YES

▶ Go to "Ground Circuit Inspeciton" procedure.

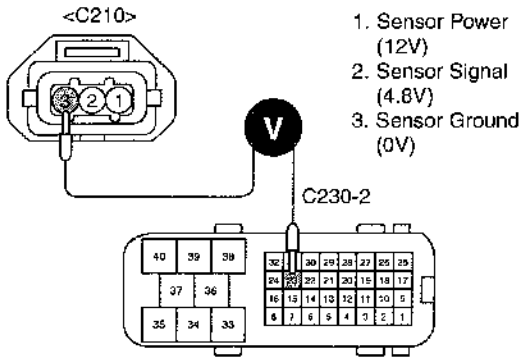
NO

▶ Check for open or short in harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION EFB4F2C3

1. Ignition "OFF" & Engine "OFF".
2. Disconnect CMPS and ECM connector.
3. Measure resistance between terminal 3 of the sensor harness connector and terminal 23 of ECM harness connector.

Specification : Approx. below 1Ω



4. Is the measured resistance within specifications ?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Check for open in harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E3D61A32

1. Check Dowel Pin
   1) Ignition "OFF" & Engine "OFF".
   2) Remove CMPS.
   3) Visually check that Dowel Pin is O.K through the installation hole for CMPS.
   4) Is the Phase on the camshaft O.K ?

   YES

   ▶ Go to "Check CMPS" as below.

   NO

   ▶ Check Dowel Pin on Camshaft for deterioration or damage.
   Replace Camshaft as necessary and go to "Verification of Vehicle Repair" procedure.
2. Check CMPS
   1) Ignition "OFF" & Engine "OFF".
   2) Remove CMPS and then connect CMPS connector to CMPS.
   3) Ignition "ON" & Engine "OFF".
   4) Move a metal on the detecting edge of CMPS with monitoring signal waveform.
   5) Is the signal waveform displayed ?

YES

▶ Substitute with a known-good ECM and check for proper operation. If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Substitute with a known-good CMPS and check for proper operation. If the problem is corrected, replace CMPS and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E87FEECE

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle within DTC Enable conditions in General information.
3. Are any DTCs present ?

YES

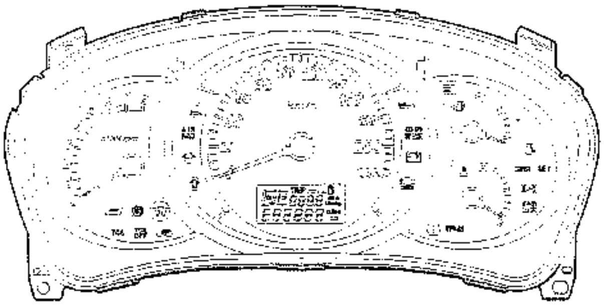
Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

DTC P1321 | GLOW INDICATOR LAMP SHORT

COMPONENT LOCATION E4DD34D7



P1321-1

DESCRIPTION EE1B5B5A

GENERAL DESCRIPTION

The glow indicator lamp is used to notify the driver when the glow plug is in operation. The glow indicator lamp are shut off when the battery voltage is low. The duration of preheating and illumination of glow indicator lamp are entirely controlled by the injection computer depending on the engine operating conditions.

Preheating begins as soon as the ignition is switched on. Postheating consists of alternately supplying the preheating resistors after the engine has been started. But preheating warning lamp is not illuminated during preheating.

All glow phases except the pre and the start-ready glow are switched off at engine off.

And then the glow indicator lamp is illuminated for at least the time during the pre-glow and start-ready phase by the ECM.

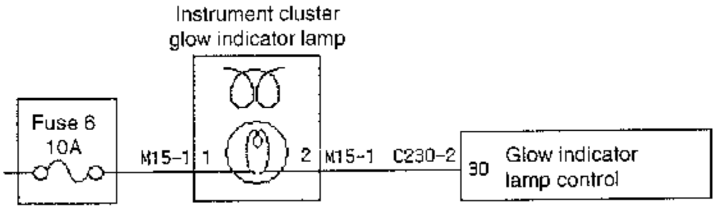
DTC DESCRIPTION

If the glow indicator lamp circuit generates threshold value, the ECM judged this as a fault and DTC is set.

DTC DETECTING CONDITION ED73D96B

Item	Detecting Condition	Possible Cause
DTC Strategy	• Circuit continuity check	• Open or short in lamp control circuit • Fuse • Faulty bulb • Faulty ECM
Enable Conditions	• Ignition on	
Threshold Value	• Short for glow indicator lamp control circuit	
Diagnostic Time	• 2 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• No • No • No • No	

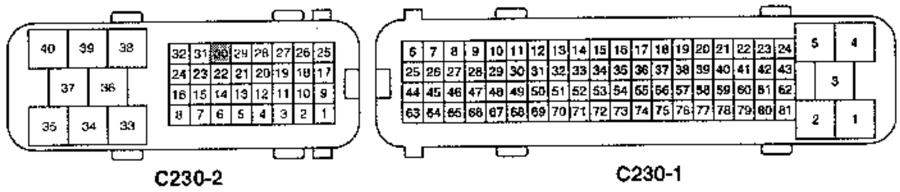
SCHEMATIC DIAGRAM EAECA7EE



[Connection Information]

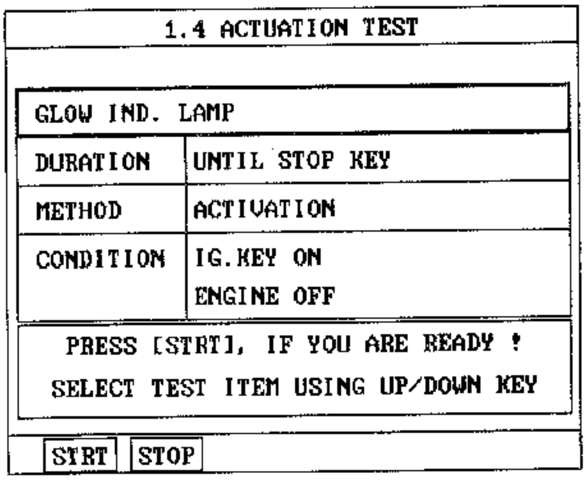
1	I/P-C Terminal 2	Glow indicator lamp power
2	C230-2 Terminal 30	Glow indicator lamp control

[CONNECTOR]



E1321-2

SIGNAL WAVEFORM EBC30574



Battery voltage is applied the glow lamp to the ECM in order to notify the driver that the ECM is preheating it to improve the engine driving performance.
For checking open or short in the wire between the fuse (10A) and the ECM, the START key should be pressed in the scan tool actuation test mode.
And then make sure that the glow indicator lamp comes on stay on during the "NOW ACTIVATING" indication

E1321-3

TERMINAL & CONNECTOR INSPECTION E9BEF2F1

1. Many malfunctions in the electrical system are caused by poor harness and terminals.
   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

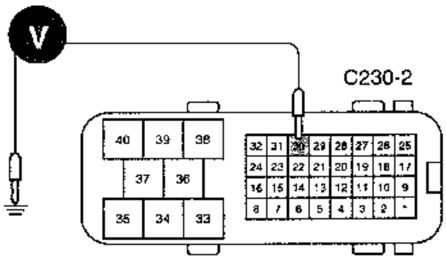
Go to " Control Circuit Inspection " procedure.

CONTROL CIRCUIT INSPECTION ECDA2FF0

1. Check for open or short in harness.
   1) Ignition "OFF" & Engine "OFF".
   2) Disconnect ECM connector.
   3) Ignition "ON" & Engine "OFF".
   4) Measure voltage between terminal 30 of ECM harness connector and chassis ground.

Specification : Approx. 10.8 ~ 13V

30. Glow Indicator Control



E1321-4

   5) Is the measured voltage within specifications ?

YES

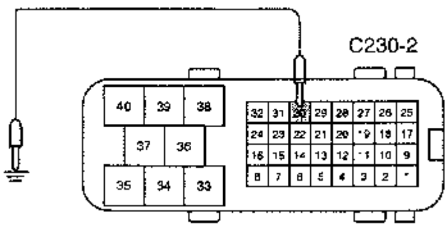
▶ Go to " Check Glow indicator lamp circuit " as below.

NO

▶ Check for open or short in the control harness.
Check that 10A Fuse is not install or blown.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Operation of Glow indicator lamp circuit.
   1) Ignition "OFF" & Engine "OFF".
   2) Disconnect ECM connector.
   3) Ignition "ON" & Engine "OFF".
   4) Jump between terminal 30 of the ECM harness connector and chassis ground with jumper wire.

30. Glow Indicator Control



E1321-5

5) Is the glow indicator lamp turned ON when jumping ?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Check for short to battery between terminal 2 of instrument panel harness and terminal 30 of ECM harness connector.

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EF617795

1. Check bulb.
   1) Ignition "OFF" & Engine "OFF".
   2) Remove bulb from instrument panel after removing instrument panel.
   3) Apply 12 voltage to bulb and ground it so that the bulb is turned on.

   Specification : Bulb is turned ON when applying 12V

   4) Is the bulb turned ON ?

YES

▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure .

NO

▶ Substitute with a known-good ECM and check for proper operation.
If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E5594C0D

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle within DTC Enable conditions in General information.
3. Are any DTCs present ?

YES

Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

DTC P1322 | GLOW INDICATOR LAMP - OPEN OR SHORT CIRCUIT

COMPONENT LOCATION E8A56208

Refer to DTC P1321.

DESCRIPTION E66E6910

GENERAL DESCRIPTION

Refer to DTC P1321.

DTC DESCRIPTION

If the glow indicator lamp circuit generates threshold value, the ECM judged this as a fault and DTC is set.

DTC DETECTING CONDITION E1E7BEBD

Item	Detecting Condition	Possible Cause
DTC Strategy	• Circuit continuity check	• Open or short in lamp control circuit • Faulty bulb • Faulty ECM
Enable Conditions	• Ignition on	
Threshold Value	• Short for glow indicator lamp control circuit	
Diagnostic Time	• 2 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• No • No • No • No	

SCHEMATIC DIAGRAM E3CEA5B2

Refer to DTC P1321.

SIGNAL WAVEFORM EA1023F

Refer to DTC P1321.

TERMINAL & CONNECTOR INSPECTION E44439CE

1. Many malfunctions in the electrical system are caused by poor harness and terminals.

   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

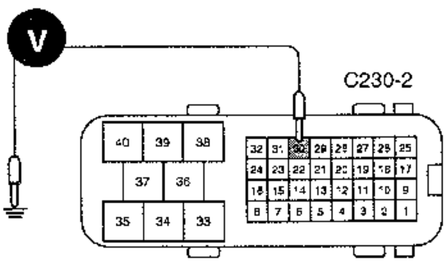
NO

Go to " Control Circuit Inspection " procedure.

CONTROL CIRCUIT INSPECTION E9DD8748

1. Check for open or short in harness.
   1) Ignition "OFF" & Engine "OFF".
   2) Disconnect ECM connector.
   3) Ignition "ON" & Engine "OFF".
   4) Measure voltage between terminal 30 of ECM harness connector and chassis ground.

   Specification : Approx. 10.8 ~ 13V



E1322-4

   5) Is the measured voltage within specifications ?

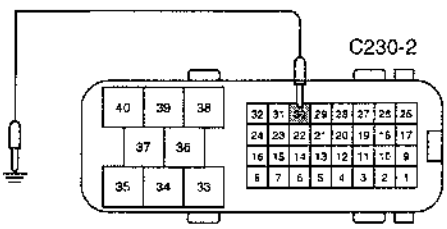
   YES

   ▶ Go to " Check Glow indicator lamp circuit " as below.

   NO

   ▶ Check for open or short in the control harness.
   Check that 10A Fuse is not install or blown.
   Repair as necessary and go to "Verification vehicle Repair" procedure.

2. Check "operation of Glow indicator lamp circuit" as below.
   1) Ignition "OFF" & Engine "OFF".
   2) Disconnect ECM connector.
   3) Ignition "ON" & Engine "OFF".
   4) Jump between terminal 30 of the ECM harness connector and chassis ground with jumper wire.



E1322-5

5) Is the glow indicator lamp turned ON when jumping ?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Check for short to battery between terminal 2 of instrument panel harness and terminal 30 of ECM harness connector.

COMPONENT INSPECTION ED425C53

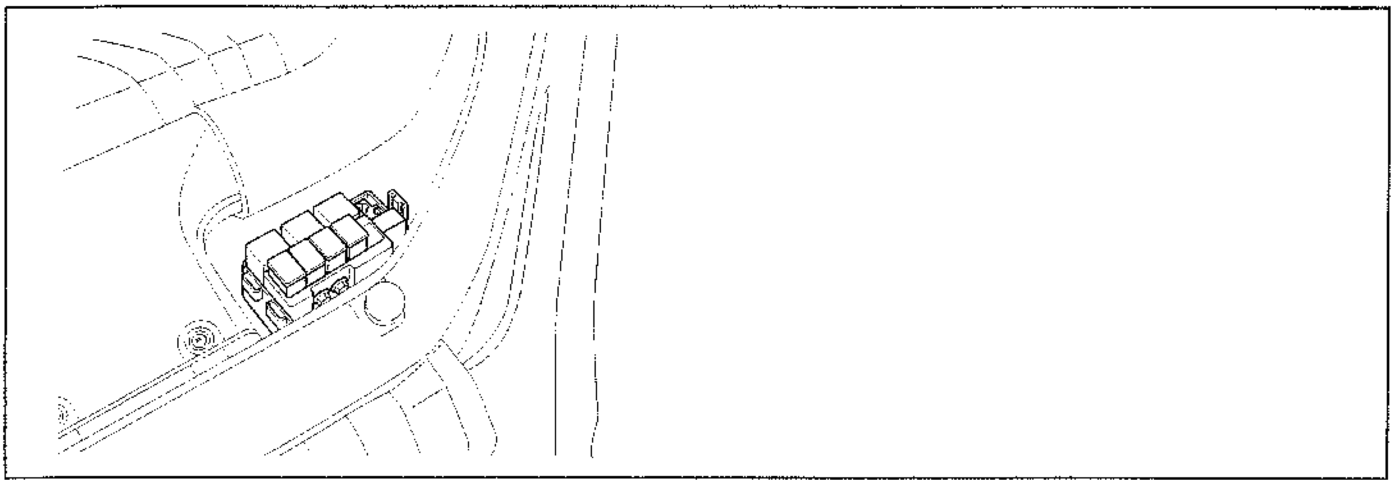
Refer to DTC P1321.

VERIFICATION OF VEHICLE REPAIR E8FF72D6

Refer to DTC P1321.

DTC P1326 | GLOW PLUG RELAY SHORT

COMPONENT LOCATION EBBBAAD5



P1326-1

DESCRIPTION EE33D7E0

GENERAL DESCRIPTION

The golw plugs are used to heat the inlet air and able to start the engine.

This heating is necessary to allow the diesel fuel to ignite when the temperature low.

The ECM controls the feed to preheating resistor via one relay.

When the ignition switch is turned on, applies the battery voltage from the heater fuse to the ECM.

The glow plug relay coil is energized to turn on the relay switch, which activates the glow plugs by the ECM, according to the signal of water temperature sensor. Feed faults are diagnosed by the ECM via the lines connected to the control terminal of the heater relay. The duration of preheating and illumination of glow indicator lamp are entirely controlled by the injection computer depending on the engine operating conditions.

In case of the glow plug relay failure, the engine symptoms will occur the glow plugs deactivation and the engine starting delayed during the cold condition.

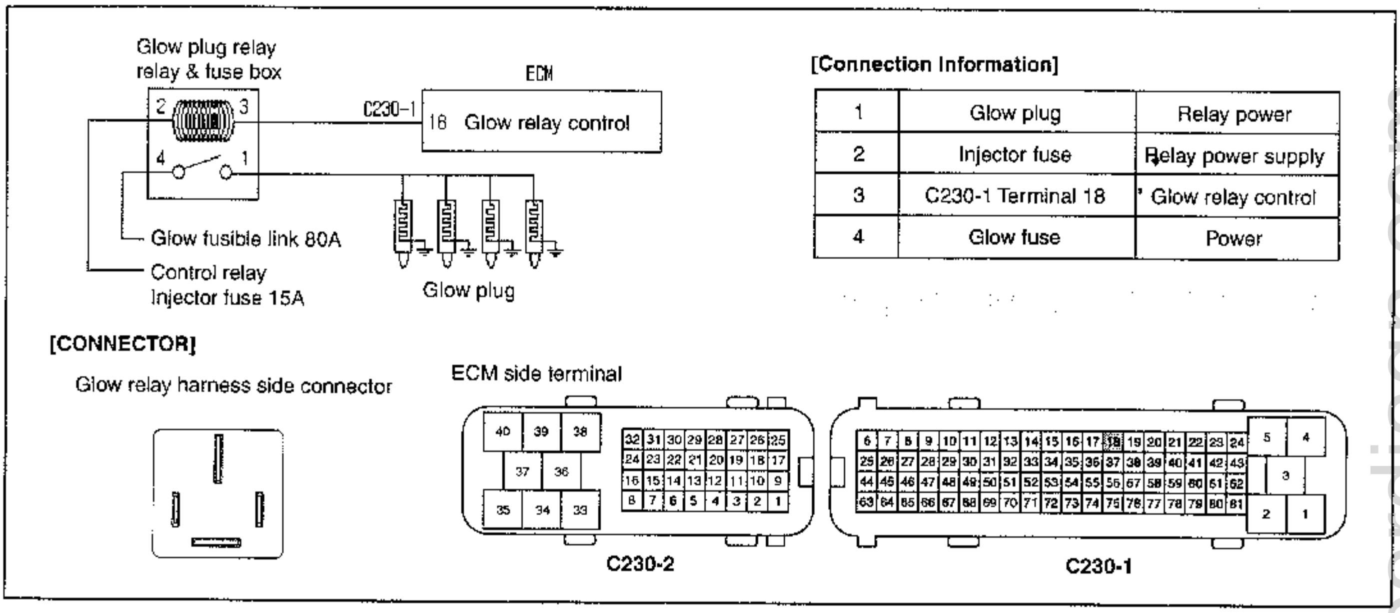
DTC DESCRIPTION

If the signal exceeds threshold value, the ECM judged this as a fault and DTC is set.

DTC DETECTING CONDITION EC2ABDEA

Item	Detecting Condition	Possible Cause
DTC Strategy	• Circuit continuity check	• Short to battery in power circuit • Short to battery in control circuit • Faulty relay • Faulty ECM
Enable Conditions	• Ignition on	
Threshold Value	• Short for glow relay control circuit	
Diagnostic Time	• 1 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• No • No • No • No	
Fail safe	• Engine speed is fixed as 1200 rpm without the accel position sensor action.	

SCHEMATIC DIAGRAM E0041B87



1	Glow plug	Relay power
2	Injector fuse	Relay power supply
3	C230-1 Terminal 18	Glow relay control
4	Glow fuse	Power

E1326-2

SIGNAL WAVEFORM E438C996

1.4 ACTUATION TEST

GLOW RELAY	
DURATION	UNTIL STOP KEY
METHOD	ACTIVATION
CONDITION	IG.KEY ON ENGINE OFF

PRESS [STRT], IF YOU ARE READY !
SELECT TEST ITEM USING UP/DOWN KEY

STRT STOP

For checking the wire and glow relay from the fuses to the glow plug, the START key should be pressed in the scan tool actuation test mode. And then make sure that the relay "click" noise could be heard.
Also, the glow relay current data should be ON while turning the ignition switch ON or idling by changing the coolant temperature.

E1328-3

MONITOR SCANTOOL DATA E9C89EFA

1. Connect scantool to Data Link Cable (DLC).
2. Monitor " Glow Relay " parameter on the scantool.

FIG 1

1.2 CURRENT DATA

×	GLOW RELAY	ON	
	BOOSTER V-OPERAT'G INJ	0.2	V
	MIL(ENGINE CHECK)	ON	
	FUEL QUANTITY	29	mcc
	FUEL PUMP RELAY	OFF	
	FAN-LOW SPEED	OFF	
	FAN-HIGH SPEED	OFF	
	A/C RELAY	OFF	

FIX SCRN FULL PART GRPH HELP

Fig 1) Glow relay ON after the ignition switch ON before coming to the coolant temperature 60°C.

Is theCurrent data displayed correctly ?

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure .

NO

▶ Go to "W/Harness Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION E6CDD4AA

1. Many malfunctions in the electrical system are caused by poor harness and terminals.
   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

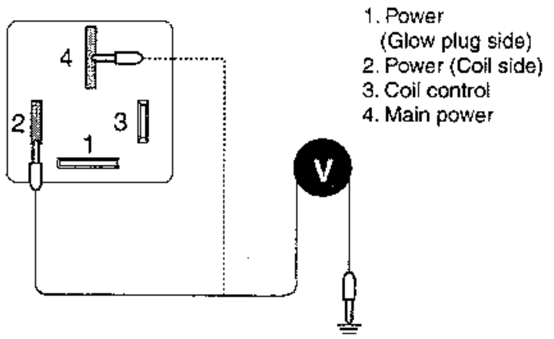
NO

Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION EF8BE2AC

1. Ignition "OFF" & Engine "OFF".
2. Disconnect Glow relay.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 4 of the relay harness connector and chassis ground.
5. Measure voltage between terminal 2 of the relay harness connector and chassis ground.

Specification : Approx. B+



E1326-5

6. Is the measured voltage within specifications ?

YES

▶ Go to " Control Circuit Inspection" procedure.

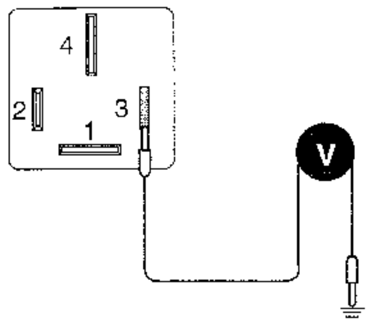
NO

▶ Check for short to battery in power harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION E31D10AC

1. Ignition "OFF" & Engine "OFF".
2. Disconnect Glow relay.
3. Measure voltage between terminal 3 of the glow relay connector and chassis ground.

Specification : Approx. below 1V



1. Power (Glow plug side)
2. Power (Coil side)
3. Coil control
4. Main power

E1326-6

4. Is the measured voltage within specifications ?

YES

▶ Go to " Component Inspection" procedure.

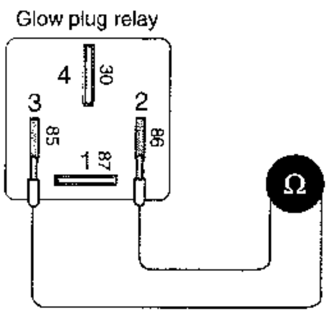
NO

▶ Check for short to battery in harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E82ED72E

1. Check Glow relay.
   1) Ignition "OFF" & Engine "OFF".
   2) Disconnect Glow relay.
   3) Measure resistance between terminal 2 and 3 of glow relay.

   Specification : 55 ± 5Ω



1. Power (Glow plug side)
2. Power (Coil side)
3. Coil control
4. Main power

E1326-7

4) Is the measured resistance within specifications ?

YES

▶ Go to "Check Glow relay operation" as below.

NO

▶ Substitute with a known-good ECM and check for proper operation.
If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.

2. Check Glow relay operation.
   1) Ignition "OFF" & Engine "OFF".
   2) Connect Glow relay and Disconnect ECM connector.
   3) Connect volt meter or test lamp with Glow plug connector (C206).
   4) Ignition "ON".
   5) Operate Glow relay by grounding terminal 18 of ECM harness connector or Select actuator test with scantool for operating glow relay.

NOTE

Time to operate glow relay should not be over than 3 sec.

Because glow plug can be damaged or Battery can be discharged.

Is the glow relay operating correctly ?

YES

▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification vehicle Repair" procedure.

NO

▶ Substitute with a known-good ECM and check for proper operation.
If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EC14CC28

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle within DTC Enable conditions in General information.
3. Are any DTCs present ?

YES

Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

DTC P1327 | GLOW RELAY - OPEN OR SHORT CIRCUIT

COMPONENT LOCATION E1FE2BCD

Refer to DTC P1326.

DESCRIPTION EDBBDF4C

GENERAL DESCRIPTION

Refer to DTC P1326.

DTC DESCRIPTION

If the signal exceeds threshold value, the ECM judged this as a fault and DTC is set.

DTC DETECTING CONDITION EACBAEC8

Item	Detecting Condition	Possible Cause
DTC Strategy	• Circuit continuity check	• Open or short to ground in power circuit • Short to ground in control circuit • Open in control circuit • Faulty relay • Faulty ECM
Enable Conditions	• Ignition on	
Threshold Value	• Short for glow relay control circuit	
Diagnostic Time	• 1 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• No • No • No • No	
Fail safe	• Engine speed is fixed as 1200 rpm without the accel position sensor action.	

SCHEMATIC DIAGRAM EB980DDD

Refer to DTC P1326.

SIGNAL WAVEFORM E976FB52

Refer to DTC P1326.

MONITOR SCANTOOL DATA EC092061

Refer to DTC P1326.

TERMINAL & CONNECTOR INSPECTION EFA0EE76

1. Many malfunctions in the electrical system are caused by poor harness and terminals.
   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

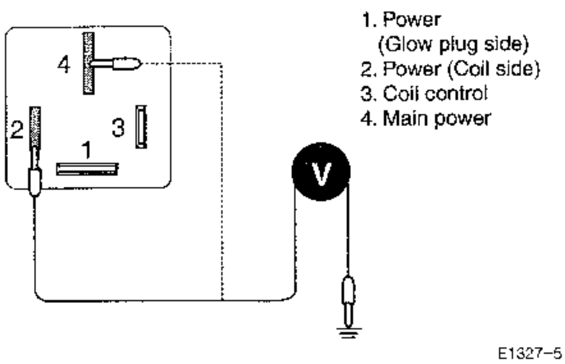
NO

Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION E4AE447D

1. Ignition "OFF" & Engine "OFF".
2. Disconnect Glow relay.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 4 of the relay harness connector and chassis ground.
5. Measure voltage between terminal 2 of the relay harness connector and chassis ground.

Specification : Approx. B+



6. Is the measured voltage within specifications ?

YES

▶ Go to " Control Circuit Inspection" procedure.

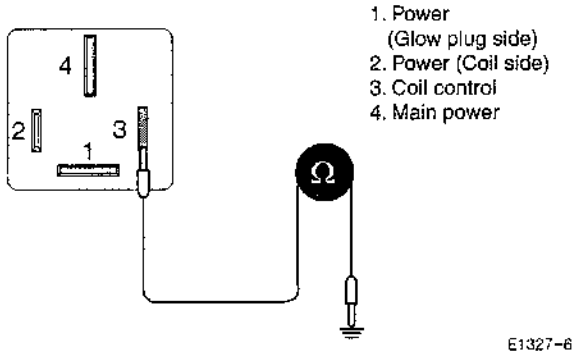
NO

▶ Check for short to battery in power harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION EE5C52EF

1. Check for short to ground in harness.
   1) Ignition "OFF" & Engine "OFF".
   2) Disconnect Glow relay.
   3) Measure voltage between terminal 3 of the glow relay connector and chassis ground.

   Specification : Infinite



   4) Is the measured resistance within specifications ?

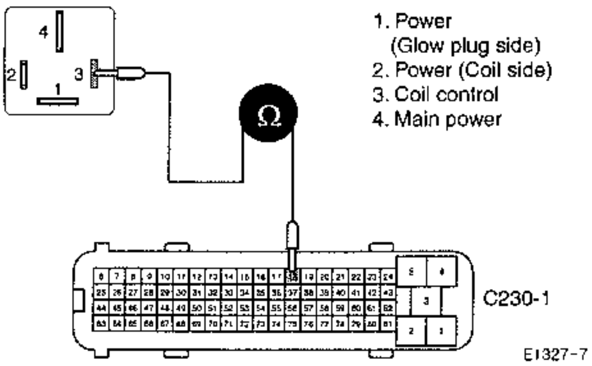
   YES

   ▶ Go to " Check for open in harness " as below

   NO

   ▶ Check for short to ground in harness.
   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for open in harness.
   1) Ignition "OFF" & Engine "OFF".
   2) Disconnect Glow relay.
   3) Measure resistance between terminal 3 of the glow relay connector and terminal 18 of ECM harness connector.



4) Is the measured resistance within specifications ?

YES

▶ Go to " Component Inspection " procedure.

NO

▶ Check for open in control harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E5A56FFB

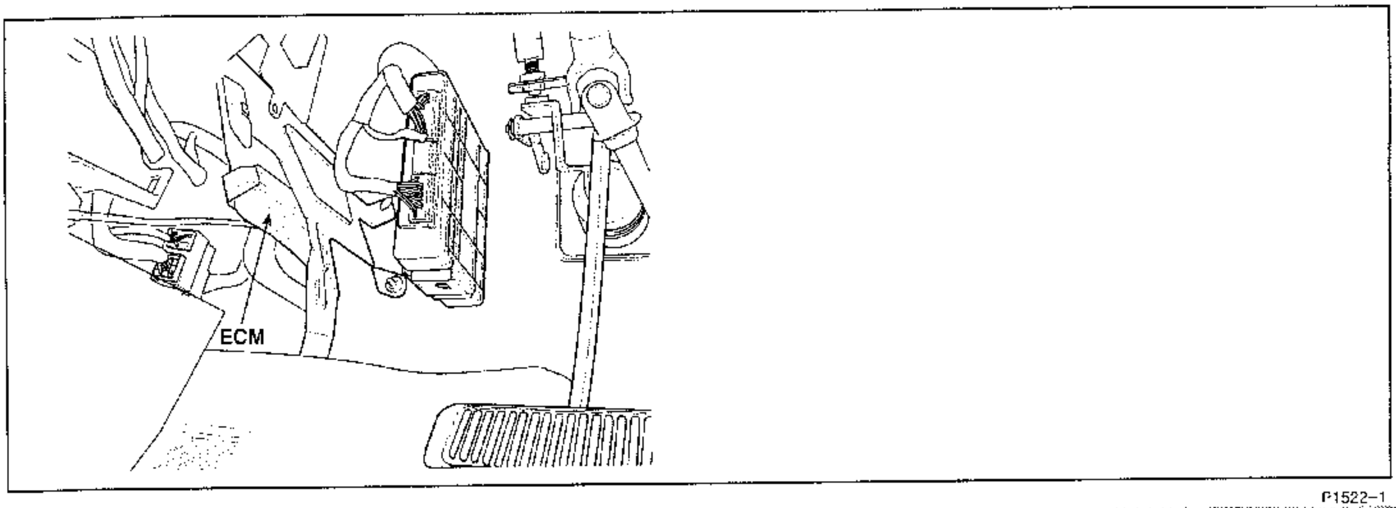
Refer to DTC P1326.

VERIFICATION OF VEHICLE REPAIR E125AE9D

Refer to DTC P1326.

DTC P1522 | SENSOR SUPPLY VOLTAGE 1 BELOW LOWER LIMIT

COMPONENT LOCATION E3951DA3



P1522-1

DESCRIPTION EC40A597

1. GENERAL DESCRIPTION

The computer has one of the management functions that is the voltage supply to the sensors.

The sensor supply votage 1 is fed to the APS 1 and MAFS to be used to operate the sensors.

2. DTC DESCRIPTION

If the signal is below threshold value, the ECM judged this as a fault and DTC is set.

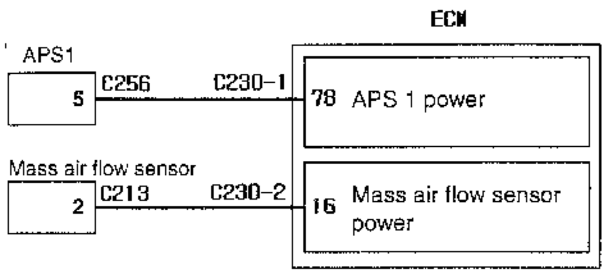
DTC DETECTING CONDITION EE7342F6

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal check, low	• Open or short to ground in power circuit • Faulty MAF or APS • Faulty ECM
Enable Conditions	• Ignition on	
Threshold Value	• Output signal < 4.7 V	
Diagnostic Time	• 0.1 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• No • Yes • No • No	
Fail safe	• Engine speed is fixed as 1200 rpm without the accel position sensor action.	

SPECIFICATION EBECF00A

Sensor supply voltage 1	
Voltage	4.8 ~ 5.1V

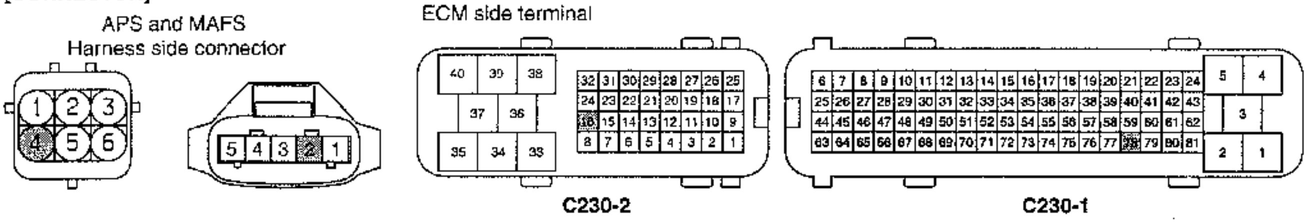
SCHEMATIC DIAGRAM EF7A6E11



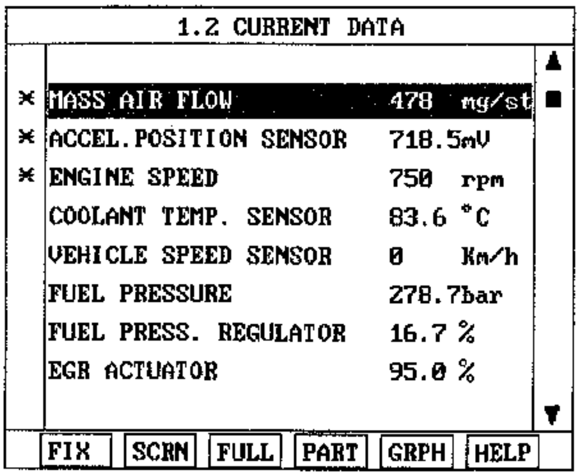
[Connection Information]

1	C230-1 Terminal 78	APS 1 power
2	C230-2 Terminal 16	MAFS power

[CONNECTOR]



SIGNAL WAVEFORM E2BF75AC



The 5 V power source in the ECM is supplied to the Mass Air Flow Sensor (MAFS), Acceleration Position Sensor 1(APS 1).
The ECM monitors this sensor supply voltage.
In case of the sensor supply voltage 1 failure, the engine symptoms is as follows.
Fast idle speed strategy at 1200 rpm without the accel position sensor action.

E1522-3

MONITOR SCANTOOL DATA EDDBA2BC

1. Connect scantool to Data Link Cable (DLC).
2. Monitor " Accel Position Sensor and Mass Air Flow " parameter on the scantool.

FIG 1

1.2 CURRENT DATA			
*	MASS AIR FLOW	477	mg/st
*	ACCEL.POSITION SENSOR	718.5mV	
*	ENGINE SPEED	748	rpm
	INT.AIR TEMP.SNSR	19.4	°C
	ACCEL.POSITION SENSOR	0.0	%
	COOLANT TEMP. SENSOR	83.9	°C
	VEHICLE SPEED SENSOR	0	Km/h
	FUEL PRESSURE	276.8bar	
FIX	SCRN FULL PART	GRPH	HELP

Fig 1) Normal value with mass air flow and accel position sensor at idle.

Is the Current data displayed correctly ?

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure .

NO

▶ Go to "W/Harness Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION EA6260BE

1. Many malfunctions in the electrical system are caused by poor harness and terminals.
   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

   YES

   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

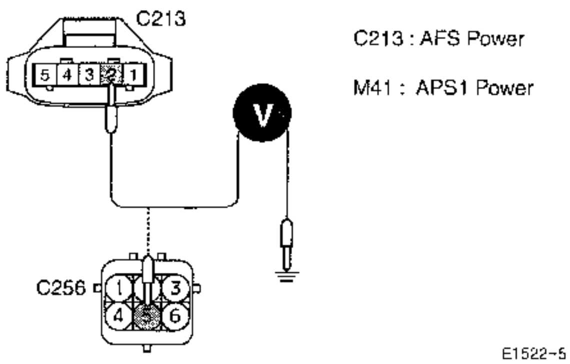
   NO

   Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION EE593EC8

1. Ignition "OFF" & Engine "OFF".
2. Disconnect MAF and Acceleration pedal sensor connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 2 of the MAFS harness connector and chassis ground.
5. Measure voltage between terminal 5 of the APS1 harness connector and chassis ground.

Specification : Approx. 4.8 ~ 5.1V



6. Is the measured voltage within specifications ?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Check for open or short to ground in harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EC3C1C45

1. Ignition "OFF" & Engine "OFF".
2. Connect MAFS & Acceleration pedal sensor 1 connector.
3. Ignition " ON" & Engine "OFF".
4. Monitor that DTC P1522 is retrieved again after connecting MAFS & APS.
5. Is the DTC P1522 retrieved again ?

YES

▶ Substitute with a known-good MAFS or/and APS and check for proper operation.
If the problem is corrected, replace MAFS or/and APS and then go to "Verification of Vehicle Repair" procedure

NO

▶ Substitute with a known-good ECM and check for proper operation.
If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure

VERIFICATION OF VEHICLE REPAIR E86E5244

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle within DTC Enable conditions in General information.
3. Are any DTCs present ?

YES

Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

DTC P1523 | SENSOR SUPPLY VOLTAGE 1 - HIGH INPUT

COMPONENT LOCATION E3E70AD8

Refer to DTC P1522.

DESCRIPTION E9ED77DF

GENERAL DESCRIPTION

Refer to DTC P1522.

DTC DESCRIPTION

If the signal above threshold value, the ECM judged this as a fault and DTC is set.

DTC DETECTING CONDITION EB1185D2

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal check, high	• Short to battery in power circuit • Faulty MAFS or APS • Faulty ECM
Enable Conditions	• Ignition on	
Threshold Value	• Output signal > 5.15 V	
Diagnostic Time	• 0.1 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• No • Yes • No • No	
Fail safe	• Engine speed is fixed as 1200 rpm without the accel position sensor action.	

SPECIFICATION E645B2E1

Sensor supply voltage 1	
Voltage	4.8 ~ 5.1V

SCHEMATIC DIAGRAM E1DD707D

Refer to DTC P1522.

SIGNAL WAVEFORM EE43CE8E

Refer to DTC P1522.

MONITOR SCANTOOL DATA E4BE2CFB

Refer to DTC P1522.

TERMINAL & CONNECTOR INSPECTION EFDADB9B

1. Many malfunctions in the electrical system are caused by poor harness and terminals.
   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

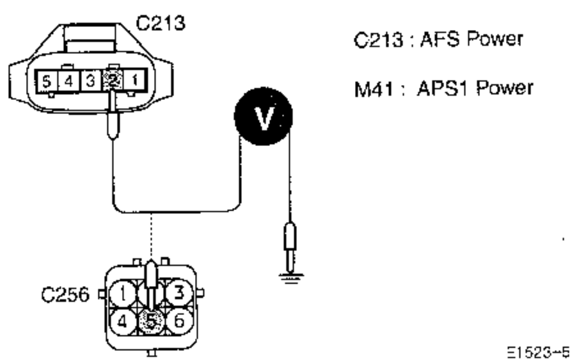
NO

Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION EC6A1FAE

1. Ignition "OFF" & Engine "OFF".
2. Disconnect MAF and Acceleration pedal sensor connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 2 of the MAFS harness connector and chassis ground.
5. Measure voltage between terminal 5 of the APS1 harness connector and chassis ground.

Specification : Approx. 4.8 ~ 5.1V



6. Is the measured voltage within specifications ?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Check for open or short to ground in harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E0D8E7A7

Refer to DTC P1522.

VERIFICATION OF VEHICLE REPAIR E305FD1A

Refer to DTC P1522.

DTC P1524 | SENSOR SUPPLY VOLTAGE 2 BELOW LOWER LIMIT

COMPONENT LOCATION E738B22F

Refer to DTC P1522.

DESCRIPTION E2C9EA24

GENERAL DESCRIPTION

Refer to DTC P1522.

DTC DESCRIPTION

If the signal is below threshold value, the ECM judged this as a fault and DTC is set.

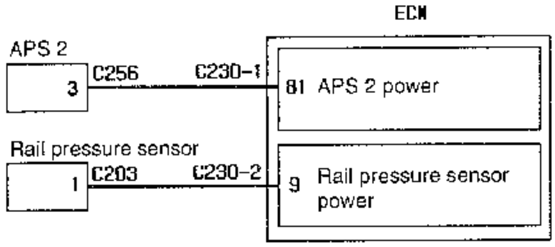
DTC DETECTING CONDITION E8CDC73C

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal check, low	• Short to battery in power circuit • Faulty RPS or APS • Faulty ECM
Enable Conditions	• Ignition on	
Threshold Value	• Output signal < 4.7 V	
Diagnostic Time	• 0.1 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• No • Yes • No • No	
Fail safe	• Engine speed is fixed as 1200 rpm without the accel position sensor action.	

SPECIFICATION EA83D5C7

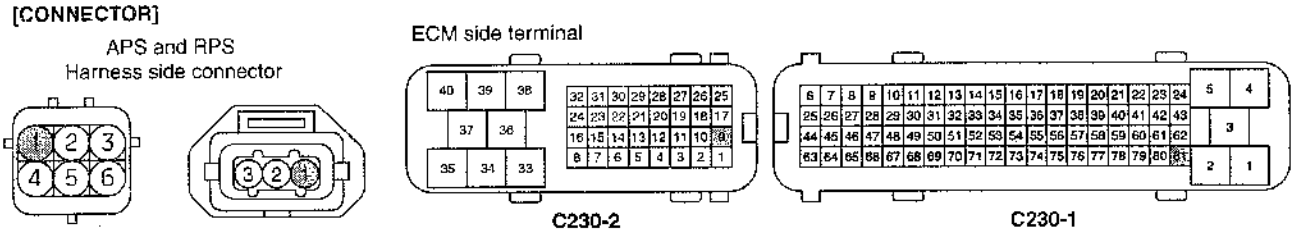
Sensor supply voltage 1	
Voltage	4.8 ~ 5.1V

SCHEMATIC DIAGRAM EFC4EBC9



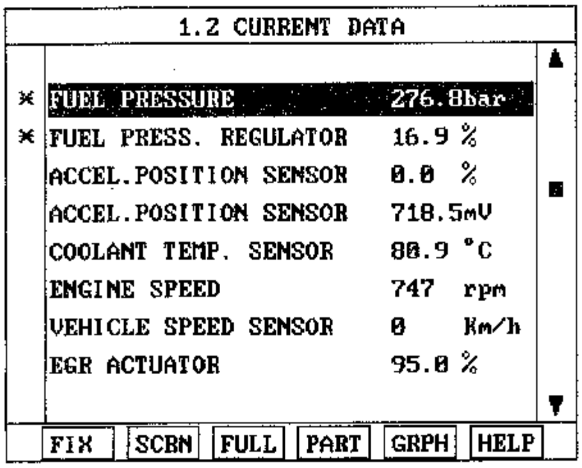
[Connection Information]

1	C230-1 Terminal 81	APS 2 power
2	C230-2 Terminal 9	RPS power



E1524-2

SIGNAL WAVEFORM E454BF54



The 5 V power source in the ECM is supplied to the rail pressure sensor (RPS), acceleration position sensor 2 (APS 2).
The ECM monitors this sensor supply voltage.
In case of the sensor supply voltage 2 failure, the engine symptoms is as follows.
Fast idle speed strategy at 1200 rpm without pedal position sensor action.

E1524-3

MONITOR SCANTOOL DATA ED141EDB

1. Connect scantool to Data Link Cable (DLC).
2. Monitor " Rail Pressure Sensor " parameter on the scantool.

FIG 1

1.2 CURRENT DATA

*	ACCEL.POSITION SENSOR	0.0 %
*	ENGINE SPEED	749 rpm
*	FUEL PRESSURE	278.7bar
	INT.AIR TEMP.SNSR	19.4 °C
	ACCEL.POSITION SENSOR	718.5mV
	COOLANT TEMP. SENSOR	84.1 °C
	VEHICLE SPEED SENSOR	0 Km/h
	FUEL PRESS. REGULATOR	16.7 %

FIX | SCRN | FULL | PART | GRPH | HELP

Fig 1) Normal value with rail pressure sensor at idle speed.

Is Current data displayed correctly ?

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "W/Harness Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION E3FFAD6E

1. Many malfunctions in the electrical system are caused by poor harness and terminals.
   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

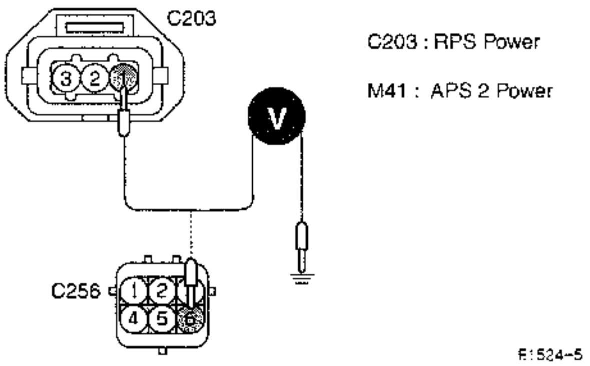
NO

Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION EEBB3B7E

1. Ignition "OFF" & Engine "OFF".
2. Disconnect RPS and Acceleration pedal sensor 2 connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 1 of the RPS harness connector and chassis ground.
5. Measure voltage between terminal 6 of the APS 2 harness connector and chassis ground.

Specification : Approx. 4.8 ~ 5.1V



6. Is the measured voltage within specifications ?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Check for short to battery in harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EBCBFAEB

1. Ignition "OFF" & Engine "OFF".
2. Connect RPS & Acceleration pedal sensor connector.
3. Ignition " ON" & Engine "OFF".
4. Monitor that DTC P1524 is retrieved again after connecting RPS & APS.
5. Is the DTC P1524 retrieved again ?

YES

▶ Substitute with a known-good RPS or/and APS and check for proper operation.
If the problem is corrected, replace RPS or/and APS and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Substitute with a known-good ECM and check for proper operation.
If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EFB957F2

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle within DTC Enable conditions in General information.
3. Are any DTCs present ?

YES

Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

DTC P1525 | SENSOR SUPPLY VOLTAGE 2 - HIGH INPUT

COMPONENT LOCATION E1767D8D

Refer to DTC P1522.

DESCRIPTION E93EE2FE

GENERAL DESCRIPTION

Refer to DTC P1522.

DTC DESCRIPTION

If the signal is above threshold value, the ECM judged this as a fault and DTC is set.

DTC DETECTING CONDITION E5CEB902

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal check, high	• Short to battery in power circuit • Faulty RPS or APS • Faulty ECM
Enable Conditions	• Ignition on	
Threshold Value	• Output signal > 5.15 V	
Diagnostic Time	• 0.1 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• No • Yes • No • No	
Fail safe	• Engine speed is fixed as 1200 rpm without the accel position sensor action.	

SPECIFICATION E7AE270F

Sensor supply voltage 1	
Voltage	4.8 ~ 5.1V

SCHEMATIC DIAGRAM ECF2A4B6

Refer to DTC P1524.

SIGNAL WAVEFORM E8A54BB5

Refer to DTC P1524.

MONITOR SCANTOOL DATA E3269AB9

Refer to DTC P1524.

TERMINAL & CONNECTOR INSPECTION EF2C6ECA

1. Many malfunctions in the electrical system are caused by poor harness and terminals.
   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

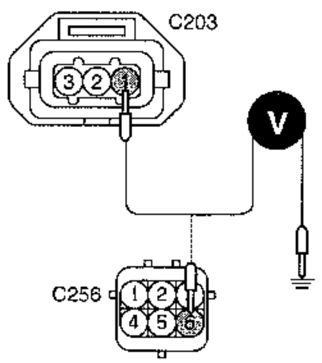
NO

Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION EBEA8D3C

1. Ignition "OFF" & Engine "OFF".
2. Disconnect RPS and Acceleration pedal sensor 2 connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 1 of the RPS harness connector and chassis ground.
5. Measure voltage between terminal 6 of the APS 2 harness connector and chassis ground.

Specification : Approx. 4.8 ~ 5.1V



C203 : RPS Power

M41 : APS 2 Power

E1525-5

6. Is the measured voltage within specifications ?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Check for open or short to ground in harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EDFCAB4B

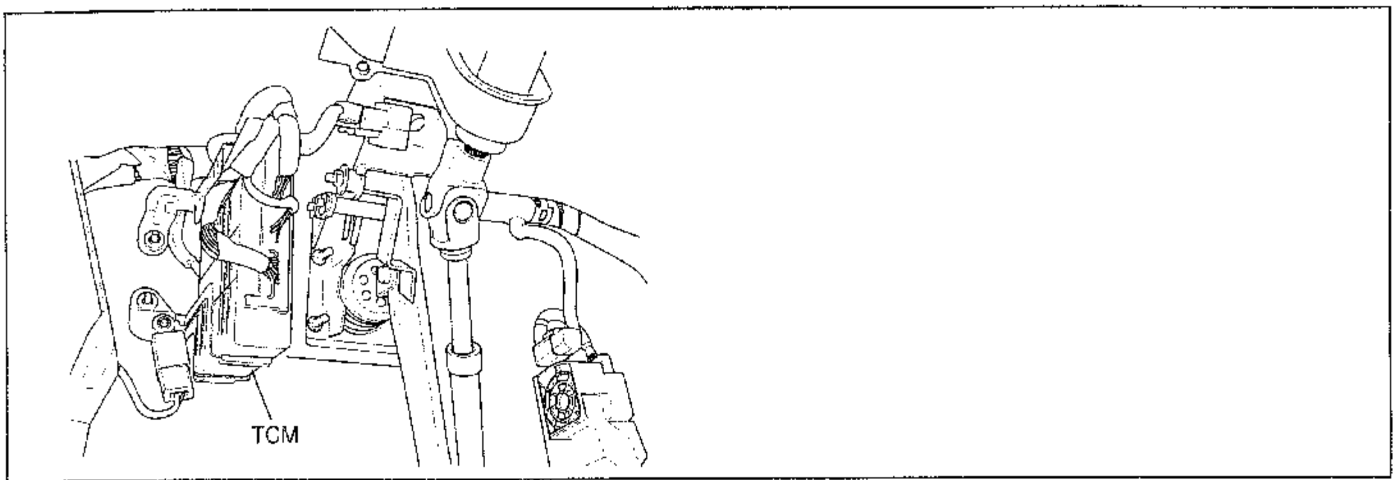
Refer to DTC P1524.

VERIFICATION OF VEHICLE REPAIR EAAC6ADE

Refer to DTC P1524.

DTC P1529 | TCU REQUEST FOR MIL ON

COMPONENT LOCATION EEA1C7D7



P1529-1

DESCRIPTION E47D24EC

1. GENERAL DESCRIPTION

Auto transaxle failure results are outputs as diagnosic codes by TCM.

In case of auto transaxle failure with locked in 3 rd gear,(AT control relay off) engine malfuntion indicator lamp is displayed by CAN communication between ECM and TCM in order to notify the driver.

2. DTC DESCRIPTION

If the auto transaxle generates threshold value, the ECM judged this as a fault and DTC is set.

DTC DETECTING CONDITION E28CFC04

Item	Detecting Condition	Possible Cause
DTC Strategy	• TCM check	• Faulty auto transaxle • Faulty ECM
Enable Conditions	• Engine run	
Threshold Value	• Auto transaxle failure with locked in 3rd gear	
Diagnostic Time	• 0.5 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• Yes • No • No • No	

MONITOR DTC STATUS E7F3CAAF

1. Connect scantool to Data Link Connector(DLC).
2. Warm up the engine to normal operating temperature.
3. Monitor that DTC P1529 is retrieved on scantool.
4. Is the DTC P1529 is retrieved on scantool ?

YES

▶ This is problem with automatic transaxle. Go to Automatic transaxle troubleshooting procedure.

NO

▶ Fault is intermittent caused by poor contact in the ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR ECF1A8BF

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle within DTC Enable conditions in General information.
3. Are any DTCs present ?

YES

Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

DTC P1545 | 1ST GEAR RECOGNITION SWITCH - SHORT CIRCUIT

DESCRIPTION EAD1532A

1. GENERAL DESCRIPTION

1st Gear Recognition Switch is used to control fuel quantity and improving a climb performance when going up a sloping road.

This monitoring is to detect the implausible input from 1 st gear recognition switch or neutral switch and carried out only once in the same driving cycle.

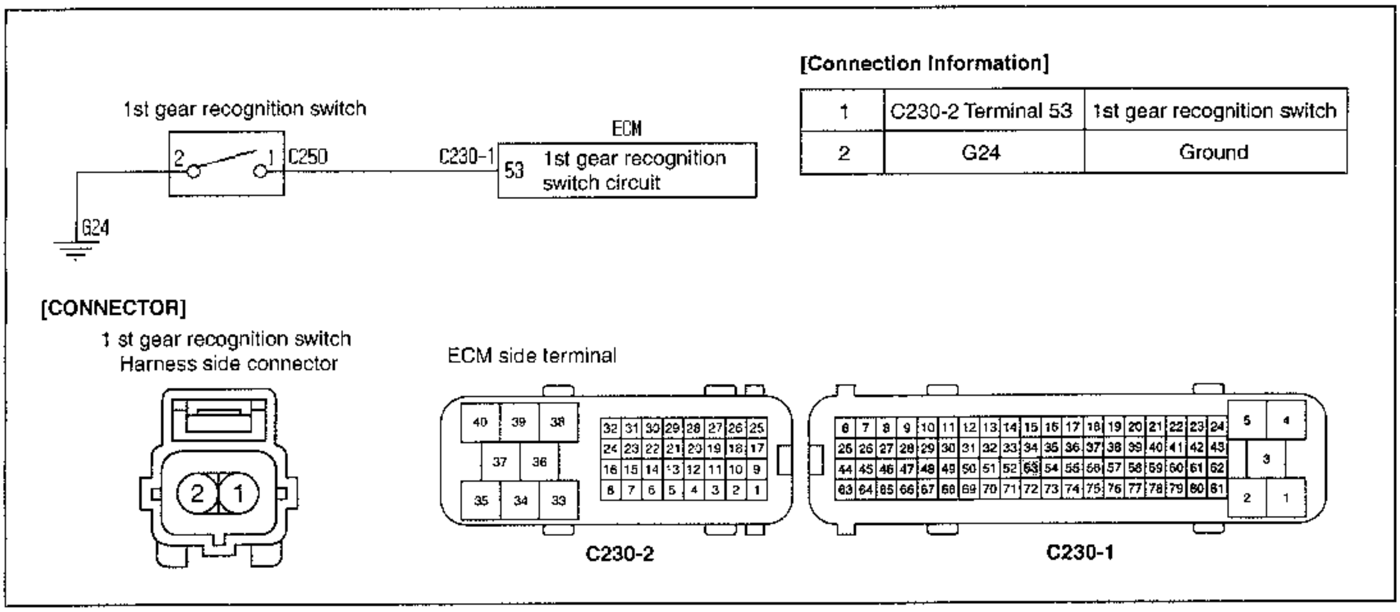
2. DTC DESCRIPTION

If the auto transaxle generates threshold value, the ECM judged this as a fault and DTC is set.

DTC DETECTING CONDITION ED78AA3D

Item	Detecting Condition	Possible Cause
DTC Strategy	• Circuit continuity check	• Short in 1st gear recognition switch power circuit • Faulty 1st gear recognition switch • Faulty ECM
Enable Conditions	• Engine run	
Threshold Value	• Short for 1st gear recognition switch circuit	
Diagnostic Time	• 1 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• No • No • No • No	

SCHEMATIC DIAGRAM EB7F7846



1	C230-2 Terminal 53	1st gear recognition switch
2	G24	Ground

E1545-2

MONITOR DTC STATUS EFC3D5CB

1. Connect scantool to Data Link Cable (DLC).
2. Monitor " 1st Gear Switch " parameter on the scantool.

FIG 1

1.2 CURRENT DATA	
* 1ST GEAR SW(MT ONLY)	ON
ACCEL.POSITION SENSOR	728.3mV
COOLANT TEMP. SENSOR	19.3 °C
ENGINE SPEED	820 rpm
VEHICLE SPEED SENSOR	0 Km/h
FUEL PRESSURE	264.0bar
FUEL PRESS. REGULATOR	15.0 %
EGR ACTUATOR	95.0 %

FIX | SCRN | FULL | PART | GRPH | HELP

Fig 1) Normal value when shifting 1 st gear.
Is the Current data displayed correctly ?

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification vehicle Repair" procedure.

NO

▶ Go to "W/Harness Inspection" procedure

TERMINAL & CONNECTOR INSPECTION E2769CDB

1. Many malfunctions in the electrical system are caused by poor harness and terminals.

   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

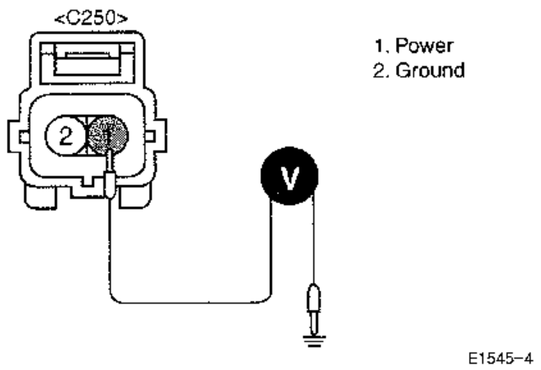
NO

▶ Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION E8FECA66

1. Ignition "OFF" & Engine "OFF".
2. Disconnect 1st gear recognition switch connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 1 of the 1st gear recognition switch harness connector and chassis ground.

Specification : Approx. B+



5. Is the measured voltage within specifications ?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Check for short to battery in the power harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E0D74FDC

1. Check 1st gear recognition switch.
   1) Ignition "OFF" & Engine "OFF".
   2) Disconnect 1st gear Recognition Switch.
   3) Measure continuity between terminal 1 and 2 of clutch switch connector (Component side).

SPECIFICATIONS

1st gear recongnition switch ON	1st gear recognition switch OFF
Continuity (Below 1Ω)	No continuity (∞ Ω)

   4) Is the measured resistance within specifications ?

YES

▶ Substitute with a known-good ECM and check for proper operation.
If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Substitute with a known-good 1st gear recognition switch and check for proper operation.
If the problem is corrected, replace 1st gear recognition switch and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EE2ABD70

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle within DTC Enable conditions in General information.
3. Are any DTCs present ?

YES

Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

DTC P1546 | 1ST GEAR RECOGNITION SWITCH - OPEN OR SHORT CIRCUIT

DESCRIPTION E15C6C79

GENERAL DESCRIPTION

Refer to DTC P1545.

DTC DESCRIPTION

If the auto transaxle generates threshold value, the ECM judged this as a fault and DTC is set.

DTC DETECTING CONDITION E6E51AEC

Item	Detecting Condition	Possible Cause
DTC Strategy	• Circuit continuity check	• Open or short to ground in 1st gear recognition switch power circuit • Open in 1st gear recognition switch ground circuit • Faulty 1st gear recognition switch • Faulty ECM
Enable Conditions	• Engine run	
Threshold Value	• Short for 1st gear recognition switch circuit	
Diagnostic Time	• 1 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• No • No • No • No	

SCHEMATIC DIAGRAM EB6288FC

Refer to DTC P1545.

MONITOR DTC STATUS EDA99D9E

Refer to DTC P1545.

TERMINAL & CONNECTOR INSPECTION ECEA0CAA

1. Many malfunctions in the electrical system are caused by poor harness and terminals.

   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

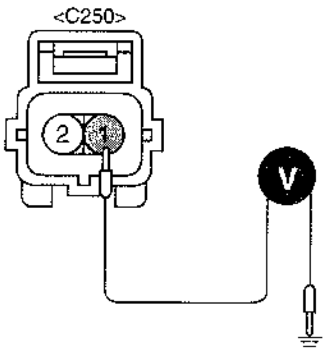
NO

▶ Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION EF80501C

1. Ignition "OFF" & Engine "OFF".
2. Disconnect 1st gear recognition switch connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 1 of the 1st gear recognition switch harness connector and chassis ground.

Specification : Approx. B+



5. Is the measured voltage within specifications ?

YES

▶ Go to " Ground Circuit Inspection" procedure.

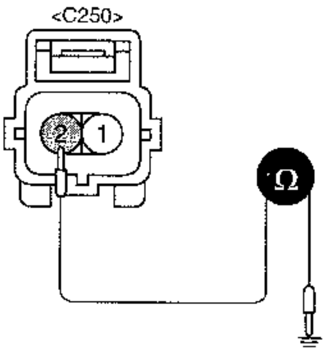
NO

▶ Check for open or short to ground in the power harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION EA4AD812

1. Ignition "OFF" & Engine "OFF".
2. Disconnect 1st gear recognition switch connector.
3. Measure resistance between terminal 2 of the 1st gear recognition switch harness connector and chassis ground of G24.

Specification : Approx. below 1Ω



EI546-5

4. Is the measured resistance within specifications ?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Check for open in harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E72436BF

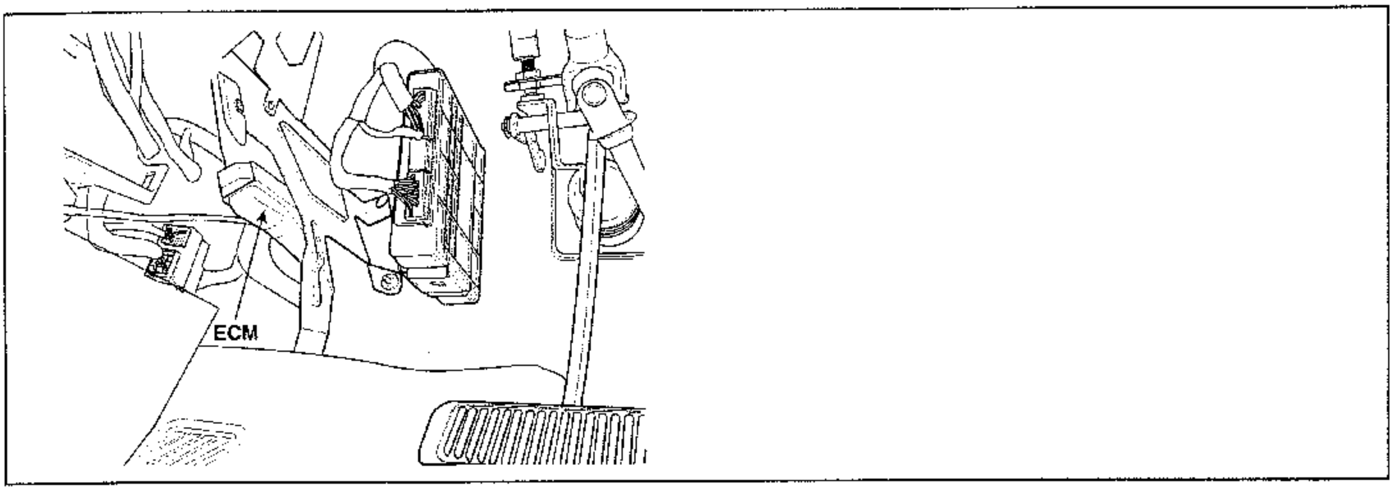
Refer to DTC P1545.

VERIFICATION OF VEHICLE REPAIR E148ECBE

Refer to DTC P1545.

DTC P1602 | SERIAL COMMUNICATION PROBLEM WITH TCU (TIME-OUT)

COMPONENT LOCATION EEDF2AC2



E1602-1

DESCRIPTION E2D6F8CB

GENERAL DESCRIPTION

The ECM communicate over the CAN are with EMS(Engine Management System), TCS(Traction Control System), TC-M(Transmission Control Moudle).

The TCM monitors various information such as vehicle speed , gear position and engine torque during upshift, it reque-sts the ECM to retard ignition timing to decrease torque.

This produces small change in torque during upshift, hence smooth shift and increase in shift feeling.

In case of the TCM failure, the engine symptoms will occur a corrupted torque reduction signal information,a shift shock, a increasing engine rpm abruptly.

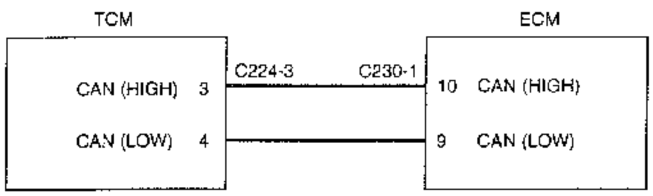
DTC DESCRIPTION

If the CAN communication generates threshold value, the ECM judged this as a fault and DTC is set.

DTC DETECTING CONDITION ED0BAD45

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal check, high and low	• Open in signal circuit • Short to ground in signal circuit • Faulty TCM • Faulty ECM
Enable Conditions	• Ignition on	
Threshold Value	• No signal through CAN communication lines.	
Diagnostic Time	• 1 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• No • No • No • No	

SCHEMATIC DIAGRAM E92DC054



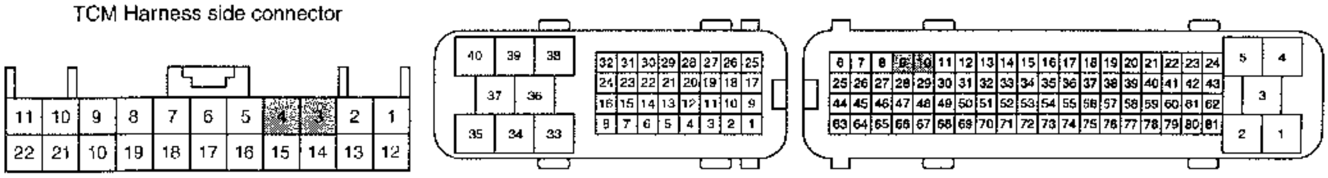
[Connection Information]

TCM	ECM	Function
C224-3 Terminal 3	C230-1 Terminal 10	CAN (high)
C224-3 Terminal 4	C230-1 Terminal 9	CAN (low)

[CONNECTOR]

TCM Harness side connector

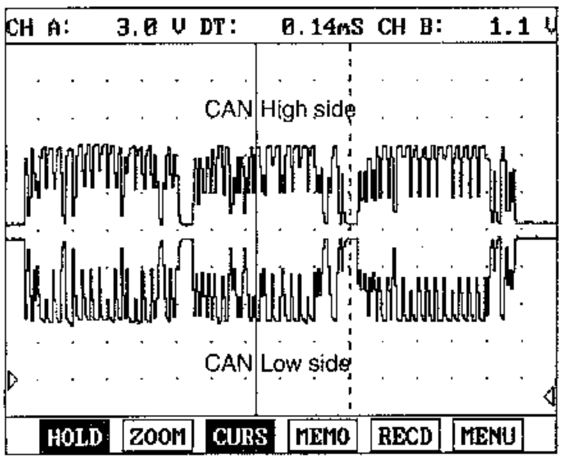
ECM side terminal



C230-2 C230-1

E1602-2

SIGNAL WAVEFORM E4C6FAD9



This test should be inspected after depressing the HOLD mode while idling.
In this CAN communication signal waveform, it is impossible to read through by displaying the scantool.
If unstable waveform pattern with non-uniform frequency or no signal, replace the ECM or the TCM after checking the wiring harness.

E1602-3

TERMINAL AND CONNECTOR INSPECTION E13CD86A

1. Many malfunctions in the electrical system are caused by poor harness and terminals.
   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

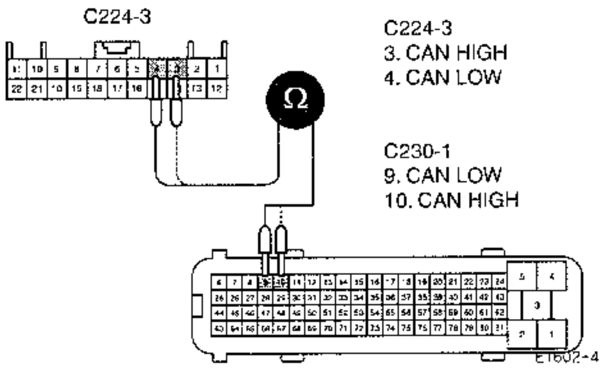
NO

Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT IHSPECTION E8A845ED

1. Check for open in harness
   1) Ignition "OFF" & Engine "OFF".
   2) Disconnect ECM & TCM connector.
   3) Measure resistance between terminal 4 of TCM harness connector and terminal 9 of ECM harness connecto-r.
   4) Measure resistance between terminal 3 of TCM harness connector and terminal 10 of ECM harness connect-or.

Specification : Approx. below 1Ω



   5) Is the measured resistance within specifications ?

YES

▶ Go to "Check for short to ground in harness" as below.

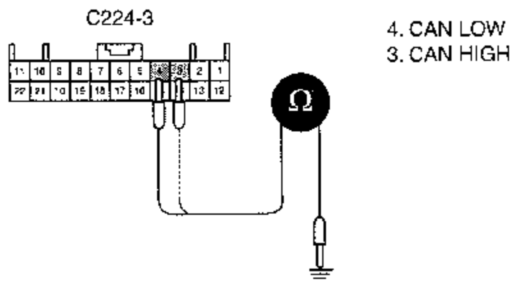
NO

▶ Check for open in the signal harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to ground in harness.
   1) Ignition "OFF" & Engine "OFF".
   2) Disconnect TCM,ECM, TCCU and HCU connector.
   3) Measure resistance between terminal 4 of TCM harness connector and chassis ground.

4) Measure resistance between terminal 3 of TCM harness connector and chassis ground.

Specification : Infinite



E1602-5

5) Is the measured resistance within specificaitons ?

YES

▶ Go to "Component Inspection" procedure.

NO

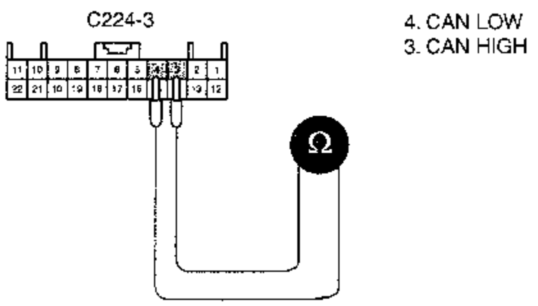
▶ Check for short to ground in signal harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EBC1ECED

1. Check resistance
   1) Ignition "OFF" & Engine "OFF".
   2) Disconnect TCM connector.
   3) Measure resistance between terminal 3 and 4 of TCM harness connector.

SPECIFICATION

Not TCS,4WD equipped			TCS, 4WD equipped
ECM & TCM connected	ECM connected only	TCM connected only	ECM & TCM connected
60Ω ± 1Ω	120Ω ± 2Ω	120Ω ± 2Ω	120Ω ± 2Ω



E1602-6

4) Is the measured resistance within specifications ?

YES

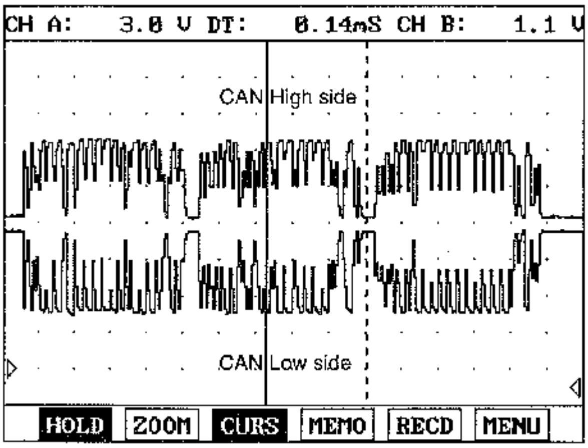
▶ Go to "Check signal waveform" as below.

NO

▶ Substitute with a known-good ECM and check for proper operation.
If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.

2. Check signal waveform
   1) Ignition "OFF" & Engine "OFF".
   2) Disconnect ECM connector.
   3) Monitor signal waveform at terminal 3 and 4 of TCM connector simultaneously.

SPECIFICATION



4) Are CAN signals generated correctly ?

YES

▶ Thoroughly check connectors for looseness, poor connection,bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Substitute with a known-good ECM and check for proper operation.
If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EE52B18A

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle within DTC Enable conditions in General information.
3. Are any DTCs present ?

YES

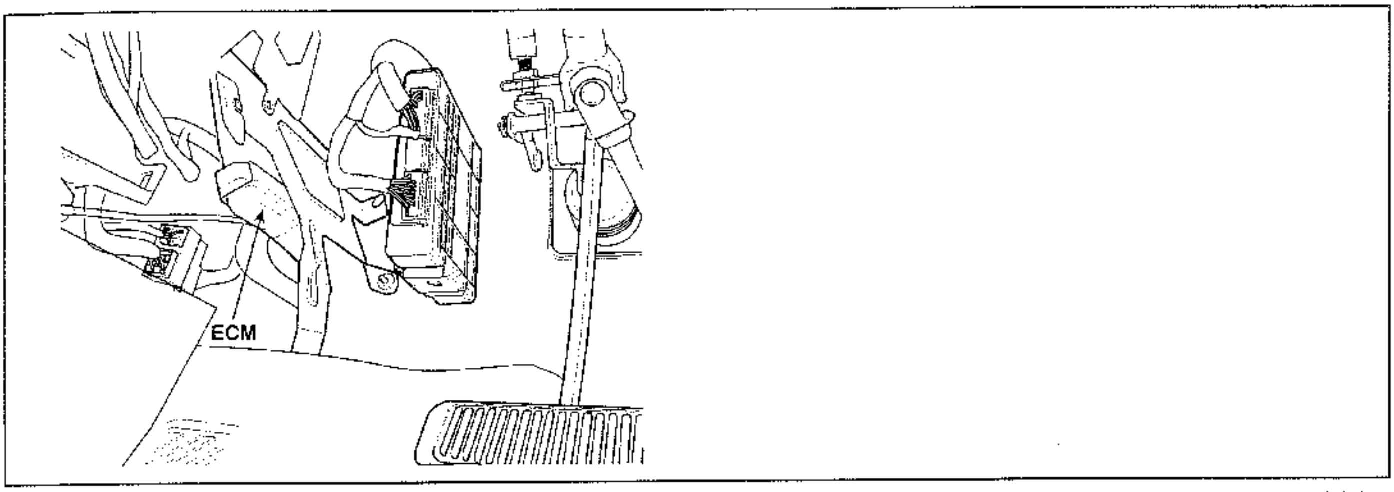
Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

DTC P1603 | CAN COMMUNICATION - BUS ERROR

COMPONENT LOCATION ECCFAF90



E1603-1

DESCRIPTION E69DB6FC

GENERAL DESCRIPTION

Refer to DTC P1602.

DTC DESCRIPTION

If the CAN communication generates threshold value, the ECM judged this as a fault and DTC is set.

DTC DETECTING CONDITION EA2F4C0B

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal check, high and low	• Open in signal circuit • Short to ground in signal circuit • Faulty TCM • Faulty ECM
Enable Conditions	• Ignition on	
Threshold Value	• CAN bus error.	
Diagnostic Time	• 1 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• No • No • No • No	

SCHEMATIC DIAGRAM EDBAAAA7

Refer to DTC P1602.

SIGNAL WAVEFORM E1B778AE

Refer to DTC P1602.

TERMINAL AND CONNECTOR INSPECTION EFAAD524

1. Many malfunctions in the electrical system are caused by poor harness and terminals.
   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

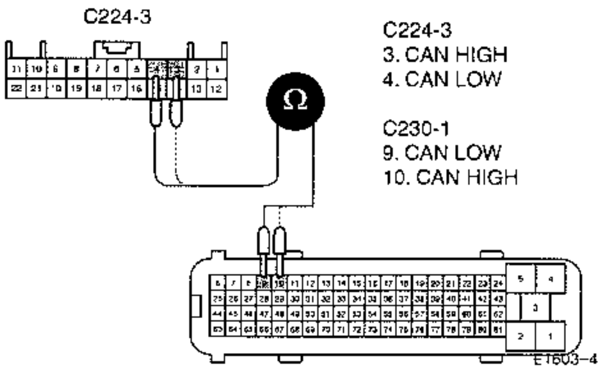
NO

Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT IHSPECTION E2BDF328

1. Check for open in harness
   1) Ignition "OFF" & Engine "OFF".
   2) Disconnect ECM & TCM connector.
   3) Measure resistance between terminal 4 of TCM harness connector and terminal 9 of ECM harness connector.
   4) Measure resistance between terminal 3 of TCM harness connector and terminal 10 of ECM harness connector.

Specification : Approx. below 1Ω



   5) Is the measured resistance within specifications ?

YES

▶ Go to "Check for short to ground in harness" as below.

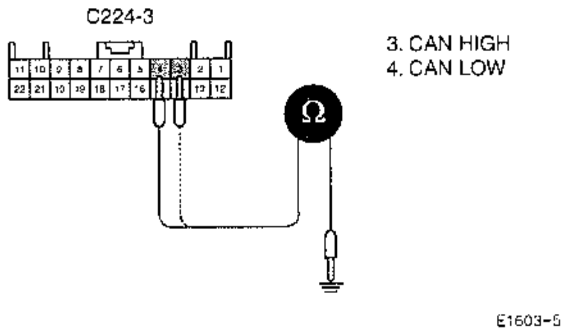
NO

▶ Check for open in the signal harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to ground in harness.
   1) Ignition "OFF" & Engine "OFF".
   2) Disconnect TCM,ECM, TCCU and HCU connector.
   3) Measure resistance between terminal 4 of TCM harness connector and chassis ground.

4) Measure resistance between terminal 3 of TCM harness connector and chassis ground.

Specification : Infinite



5) Is the measured resistance within specificaitons ?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Check for short to ground in signal harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E74DC1C8

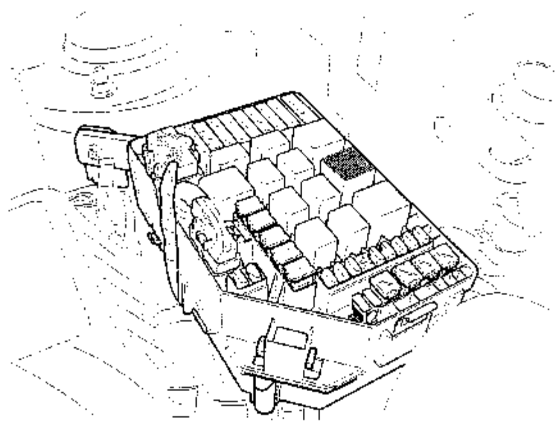
Refer to DTC P1602.

VERIFICATION OF VEHICLE REPAIR EC32AF4F

Refer to DTC P1602.

DTC P1616 | MAIN RELAY - RANGE/PERFORMANCE

COMPONENT LOCATION EEE9B6CB



P1616-1

DESCRIPTION EAA35CD0

GENERAL DESCRIPTION

The voltage after the main relay is used to supply power to the sensors and actuators.

ECM controls the main relay and its remains ON at key OFF in order to store the adaptaion values and fault status to the memory.

When the ignition switch is turned ON, current flows from the ignition switch through the current and the main relay coil to ground by the ECM.

And then, the voltage is supplied to the sensors and actuators to drive.

In case of the the main relay failure, the engine symptoms will occur a running engine stall, a starting impossible and glow plug deactivation.

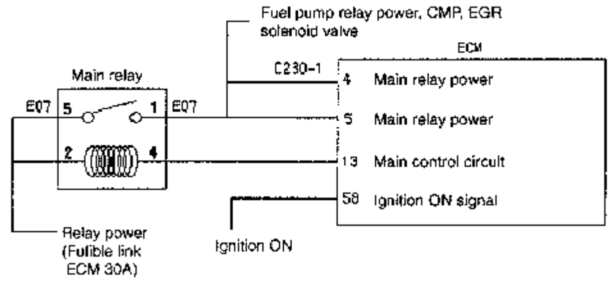
DTC DESCRIPTION

If the signal exceeds threshold value, the ECM judged this as a fault and DTC is set.

DTC DETECTING CONDITION E5B3015D

Item	Detecting Condition	Possible Cause
DTC Strategy	• Circuit continuity check	• Opne or short in power circuit • Open or short in relay control circuit • Faulty relay • Faulty ECM
Enable Conditions	• Ignition on and off	
Threshold Value	• main relay shut off time is too early or late when comeparing the ignition on/off time with the ECM microcomputer signal.	
Diagnostic Time	• 0 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• Yes • No • No • No	
Fail safe	• EGR valve deactivited • Fuel quantity limitation	

SCHEMATIC DIAGRAM EBBA7F65

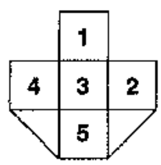


[Connection Information]

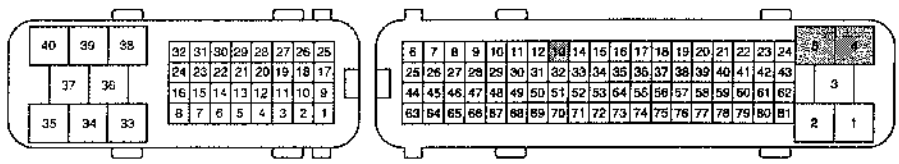
1	C230-1 Terminal 4,5	Relay power supply
2	Power	Relay, coil power
3	-	-
4	C230-1 Terminal 13	Relay control circuit
5	Power	Relay power supply

[CONNECTOR]

Main relay Harness side connector



ECM side terminal



E1616-2

MONITOR SCANTOOL DATA E56E966F

1. Connect scantool to Data Link Cable (DLC).
2. Monitor " Battery Voltage " parameter on the scantool.

FIG 1

1.2 CURRENT DATA

*	BATTERY VOLTAGE	14.1 V
	ACCEL.POSITION SENSOR	0.0 %
	ACCEL.POSITION SENSOR	728.3mV
	COOLANT TEMP. SENSOR	53.3 °C
	ENGINE SPEED	774 rpm
	VEHICLE SPEED SENSOR	0 Km/h
	FUEL PRESSURE	256.7bar
	FUEL PRESS. REGULATOR	15.6 %

FIX | SCRN | FULL | PART | GRPH | HELP

Fig 1) Normal value without EGR actuator : Approx. 450 ~ 550 mg/stroke

Is the Current data displayed correctly ?

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure .

NO

▶ Go to "W/Harness Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION EB28937A

1. Many malfunctions in the electrical system are caused by poor harness and terminals.

   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

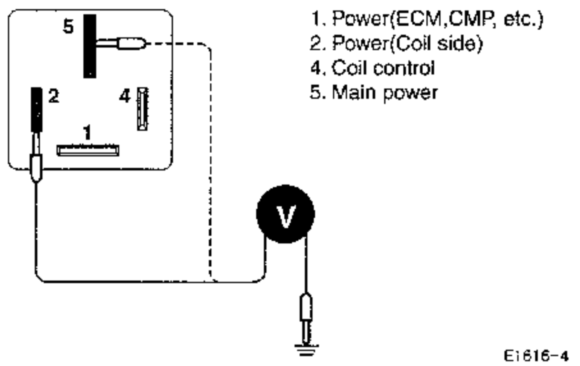
NO

Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION EB09D362

1. Ignition "OFF" & Engine "OFF".
2. Disconnect Main Relay.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 2 of the main relay harness connector and chassis ground.
5. Measure voltage between terminal 5 of the main relay harness connector and chassis ground.

Specification : B+



6. Is the measured voltage within specifications ?

YES

▶ Go to "Control Circuit Inspection" procedure.

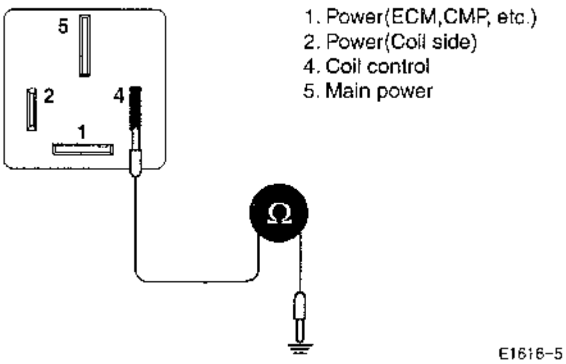
NO

▶ Check for open or short in the power harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION EC7F516A

1. Check for short to ground in harness.
   1) Ignition "OFF".
   2) Disconnect Main relay.
   3) Measure resistance between terminal 4 of the Main relay harness connector and chassis ground.

   Specification : Infinite



   4) Is the measured resistance within specifications ?

   YES

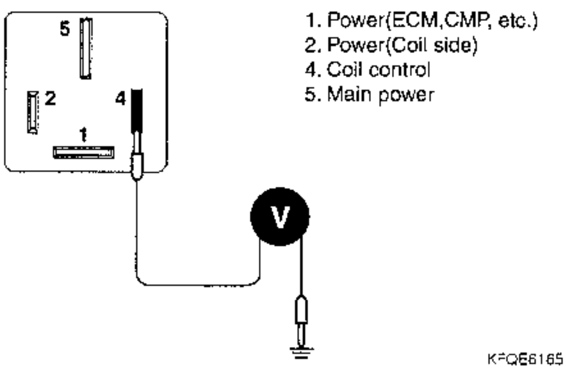
   ▶ Go to "Check for short to battery in harness" as below.

   NO

   ▶ Check for short to ground in harness.
   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to battery in harness.
   1) Ignition "OFF".
   2) Disconnect Main relay.
   3) Ignition "ON" & Engine "OFF".
   4) Measure voltage between terminal 4 of the Main relay harness connector and chassis ground.

   Specification : Approx. below 1V



5) Is the measured resistance within specifications ?

YES

▶ Go to "Check for open in harness " as below.

NO

▶ Check for short to ground in harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

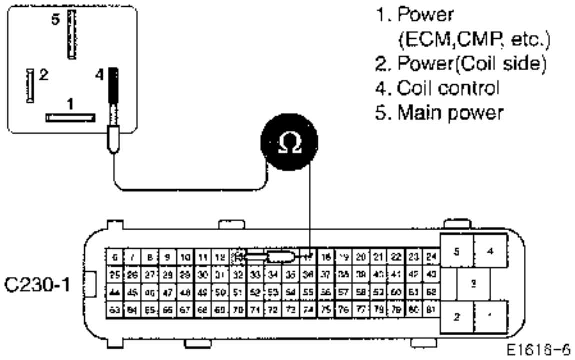
3. Check for open in harness.

1) Ignition "OFF" & Engine "OFF".

2) Disconnected MAF sensor connector and ECM connector.

3) Measure resistance between terminal 4 of the Main relay harness connector and terminal 13 of ECM harness connector.

Specification : Approx. below 1Ω



4) Is the measured resistance within specifications ?

YES

▶ Go to "Component Inspection" procedure.

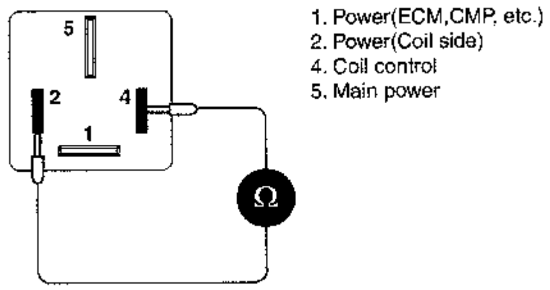
NO

▶ Check for open in harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E1C3C8ED

1. Check Main relay.
   1) Ignition "OFF" & Engine "OFF".
   2) Disconnect Main relay.
   3) Measure resistance between terminal 2 and 4 of main relay (Component side).

Specification : 70 ~ 90Ω (20°C)



KFQE6167

4) Is the measured resistance within specifications ?

YES

▶ Go to "Check Main relay operation " as below.

NO

▶ Substitute with a known-good Main relay and check for proper operation.
If the problem is corrected, replace main relay and then go to "Verification of Vehicle Repair" procedure.

2. Check Main relay operation.
   1) Ignition "OFF" & Engine "OFF".
   2) Connect Main relay and Disconnect ECM connector.
   3) Connect volt meter or test lamp with terminal 4 and 5 of ECM harness connector.
   4) Ignition "ON" & Engine "OFF".
   5) Ground terminal 13 of ECM harness connector so that Main relay operates. Or,

      Connect ECM harness connector and then, check that main relay operates if 12V is detected at terminal 58 of ECM connector after Ignition ON.
   6) Is the 12V detected on voltmeter with operating main relay ?

YES

▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Substitute with a known-good ECM and check for proper operation.
If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E5777DFD

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle within DTC Enable conditions in General information.
3. Are any DTCs present ?

YES

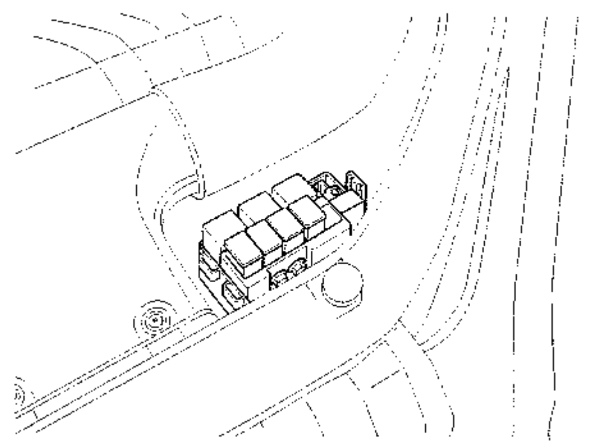
Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

DTC P1634 | WATER HEATER RELAY MALFUNCTION

COMPONENT LOCATION E0FE2CFA



P1634-1

DESCRIPTION E6ED91F0

GENERAL DESCRIPTION

The direct injection engine is characterised by improved thermodynamic efficiency compared to an indiret injection engine, due to the reduction in heat loss via the walls. The coolant is used by the passenger compartment heating system-.

In extream cold conditions, it is therefore difficult to reach a comfortable temperature in the passenger compartment.

To reduce the length of the increase in the temperature phase, vehicles powered by direct injection engines are fitted with heating resistors located directly in the cooling circuit.

The electrical power of each water heater component is 300 W. The water heater relay coil is energized to turn on the relay switch, which activates the water heaters by the ECM, according to the signal of water temperature sensor.

The ECM cuts the feed to the water heaters when the period determined by the map has expired or when the coolant temperature exceeds 65 ℃. Supply may also be cut for a moment if the battery voltage drops below 10 V.

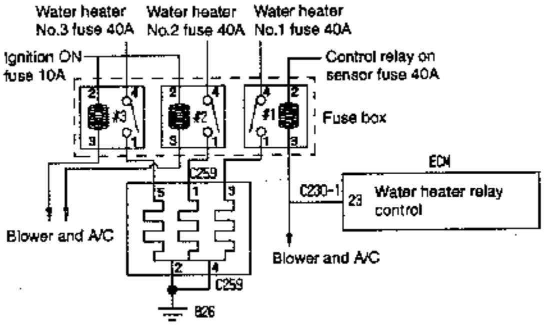
DTC DESCRIPTION

If the signal exceeds threshold value, the ECM judged this as a fault and DTC is set.

DTC DETECTING CONDITION EF2B1F0C

Item	Detecting Condition	Possible Cause
DTC Strategy	• Circuit continuity check	• Opne or short in power circuit • Open or short in water heater relay control circuit • Faulty relay • Faulty ECM
Enable Conditions	• Ignition on	
Threshold Value	• Open or short for water heater relay control circuit.	
Diagnostic Time	• 1 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• No • No • No • No	
Fail safe	• EGR valve deactivited • Fuel quantity limitation	

SCHEMATIC DIAGRAM EF2151D

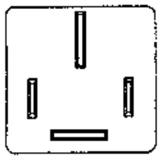


[Connection Information]

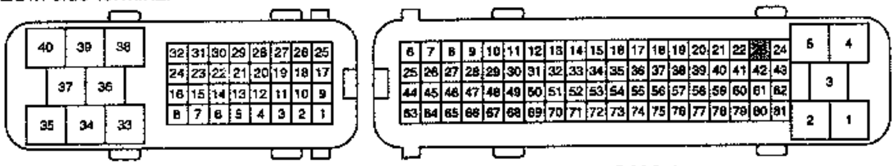
1	C259 Terminal 3	Water heater power supply
2	C259 Terminal 16	Relay power
3	C230-1 Terminal 23	Water heater relay control
4	Fuse 40A	Power

[CONNECTOR]

Water heater relay
Harness side connector



ECM side terminal



C230-2 C230-1

E1634-2

MONITOR SCANTOOL DATA EB0BE3B0

1. Connect scantool to Data Link Cable (DLC).
2. Monitor " Water Heater Realy Operation Relay and Coolant Temperature " parameter on the scantool .

FIG 1

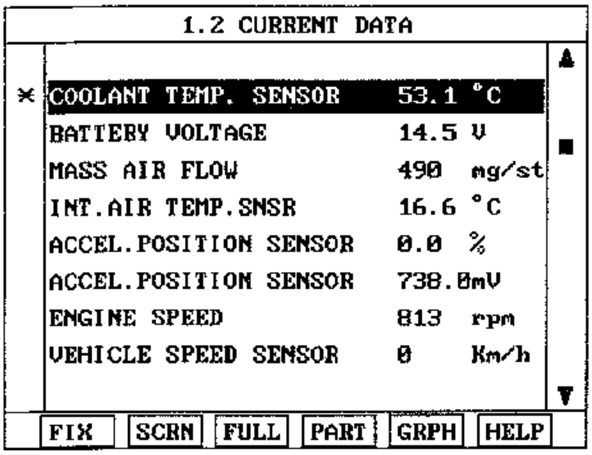


Fig 1) Make sure that water heater relay ON before coming to the coolant temperature 60°C.

Is the Current data displayed correctly ?

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and goto "Verification of Vehicle Repair" procedure.

NO

▶ Go to "W/Harness Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION EC63D12E

1. Many malfunctions in the electrical system are caused by poor harness and terminals.
   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

   YES

   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

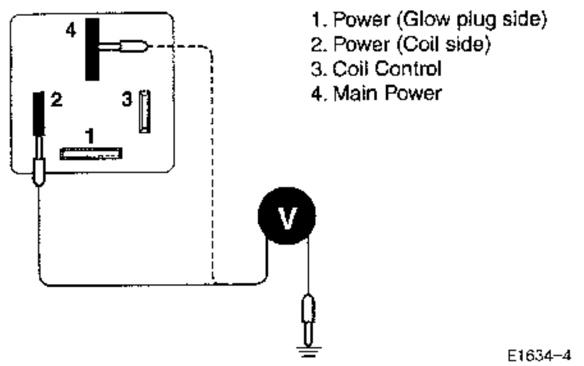
   NO

   Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION E1CE58B4

1. Ignition "OFF".
2. Disconnect Water heater relay 1.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 2 of the water heater relay and chassis ground.
5. Measure voltage between terminal 4 of the water heater relay and chassis ground.

Specification : 11.5V~13.5V



6. Is the measured voltage within specifications ?

YES

▶ Go to "Control Circuit Inspection" procedure.

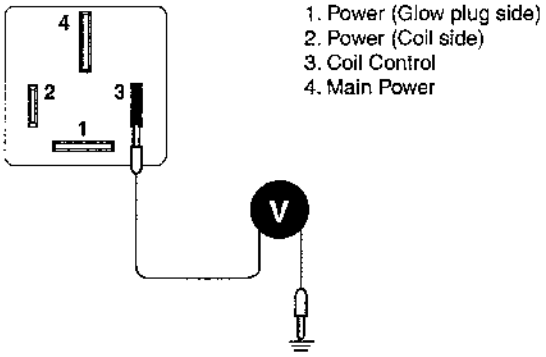
NO

▶ Check for open or short in the power harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION EDEA8DC3

1. Check for short to ground in harness.
   1) Ignition "OFF".
   2) Disconnect water heater relay 1.
   3) Ignition "ON" & Engine "OFF".
   4) Measure voltage between terminal 3 of the water relay and chassis ground.

Specification : Approx. below 1V



   5) Is the measured resistance within specifications ?

YES

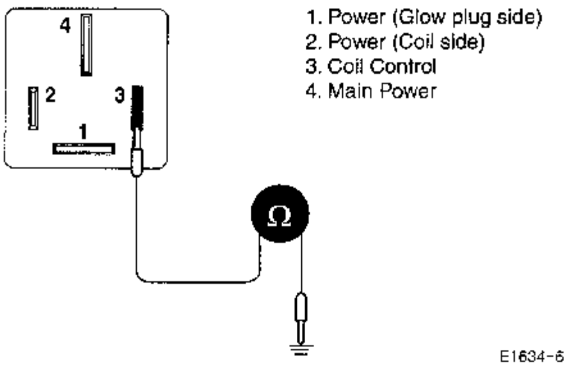
▶ Go to "Check for short to ground in harness" as below.

NO

▶ Check for short to ground in harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to battery in harness.
   1) Ignition "OFF".
   2) Disconnect water heater relay 1.
   3) Measure resistance between terminal 3 of the water heater relay and chassis ground.

Specification : Infinite



4) Is the measured resistance within specifications ?

YES

▶ Go to "Check for open in harness " as below.

NO

▶ Check for short to ground in harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

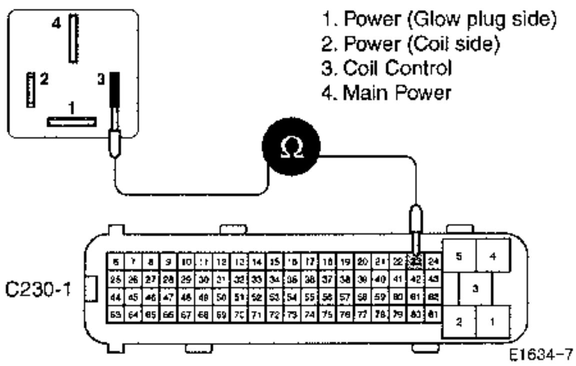
3. Check for open in harness.

1) Ignition "OFF".

2) Disconnect water heater relay 1 and ECM connector.

3) Measure resistance between terminal 3 of the water heater relay and terminal 23 of ECM harness connector-.

Specification : Approx. below 1Ω



4) Is the measured resistance within specifications ?

YES

▶ Go to "Component Inspection" procedure.

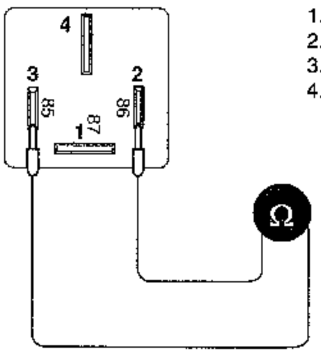
NO

▶ Check for open in harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EA813348

1. Check water heater relay 1.
   1) Ignition "OFF" & Engine "OFF".
   2) Disconnect water heater relay.
   3) Measure resistance between terminal 2 and 3 of water heater relay connector (Component side).

   Specification : 50 ~ 60Ω



1. Power (Glow plug side)
2. Power (Coil side)
3. Coil Control
4. Main Power

E1634-8

   4) Is the measured resistance within specifications ?

   YES

   ▶ Go to " Check for water heater relay operation " as below.

   NO

   ▶ Substitute with a known-good Main relay and check for proper operation.
   If the problem is corrected, replace main relay and then go to "Verification of Vehicle Repair" procedure.

2. Check water heater relay operation.
   1) Ignition "OFF" & Engine "OFF".
   2) Connect water heater relay 1,2 and 3 and disconnect ECM connector.
   3) Connect volt meter or test lamp with terminal 3 of water heater connector.
   4) Ignition "ON" & Engine "OFF".
   5) Ground terminal 23 of ECM harness connector to operate water heater relay. Or,
   Check that water heater relay operates after Engine starts(Perform this test under 60°C).

   NOTE

   Time to operate water heater relay should not be over than 3 sec.

   Because water heater plug can be damaged or Battery can be discharged.

   6) Is the power supplied to water heater plug by operating water heater relay ?

   YES

   ▶ Substitute with a known-good ECM and check for proper operation.
   If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.

   NO

   ▶ Substitute with a known-good ECM and check for proper operation.
   If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E6EF0A4F

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle within DTC Enable conditions in General information.
3. Are any DTCs present ?

YES

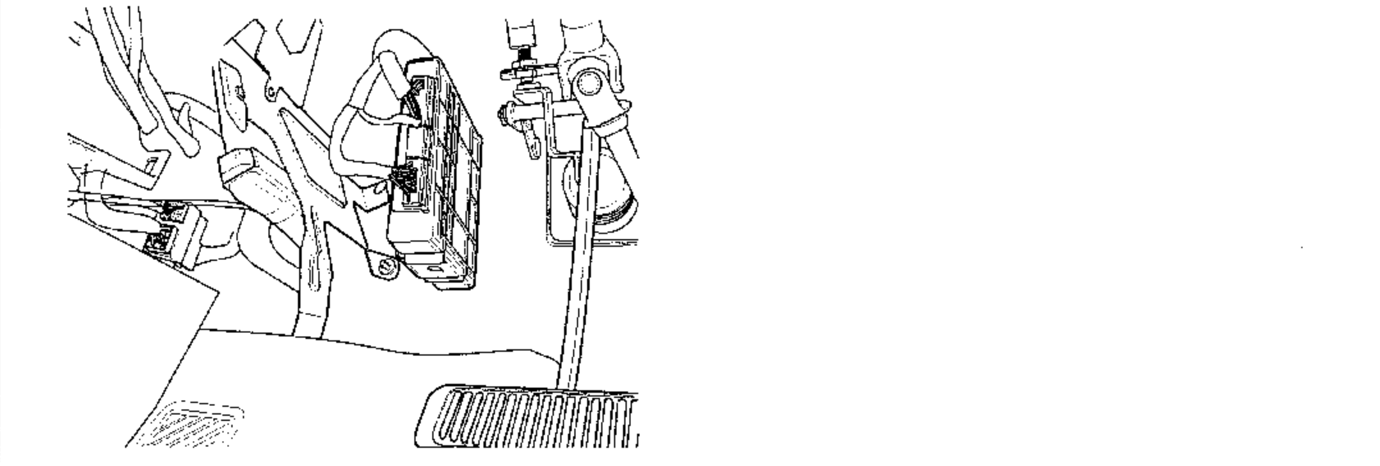
Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

DTC P1636 | VOLTAGE REGULATOR MALFUNCTION

COMPONENT LOCATION E92529DB



P1636-1

DESCRIPTION EC48DD5A

GENERAL DESCRIPTION

The Engine control module (ECM) is installed in the passenger compartment.

The ECM is a solid state device that uses internal circuitry to process the input signals according to control algorithms.

A voltage regulator inside the ECM controls power supply to output transistor.

DTC DESCRIPTION

If the signal exceeds threshold value, the ECM judged this as a fault and DTC is set.

DTC DETECTING CONDITION EFDFACDD

Item	Detecting Condition	Possible Cause
DTC Strategy	• Rationality check	• Faulty ECM
Enable Conditions	• When Ignition switch is off	
Threshold Value	• Engine < 500 rpm within 1.5	
Diagnostic Time	• 0 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• No • No • No • No	

MONITOR DTC STATUS E5D6E1E6

1. Igintion " OFF ".
2. Connect scantool and select Diagnostic Trouble Code(DTC).
3. Clear DTC and then, Monitor DTC status.
4. Is the DTC P1636 is retreived again ?

YES

Substitute with a known-good ECM and check for proper operation.
If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.

NO

Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EBBA687B

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle within DTC Enable conditions in General information.
3. Are any DTCs present ?

YES

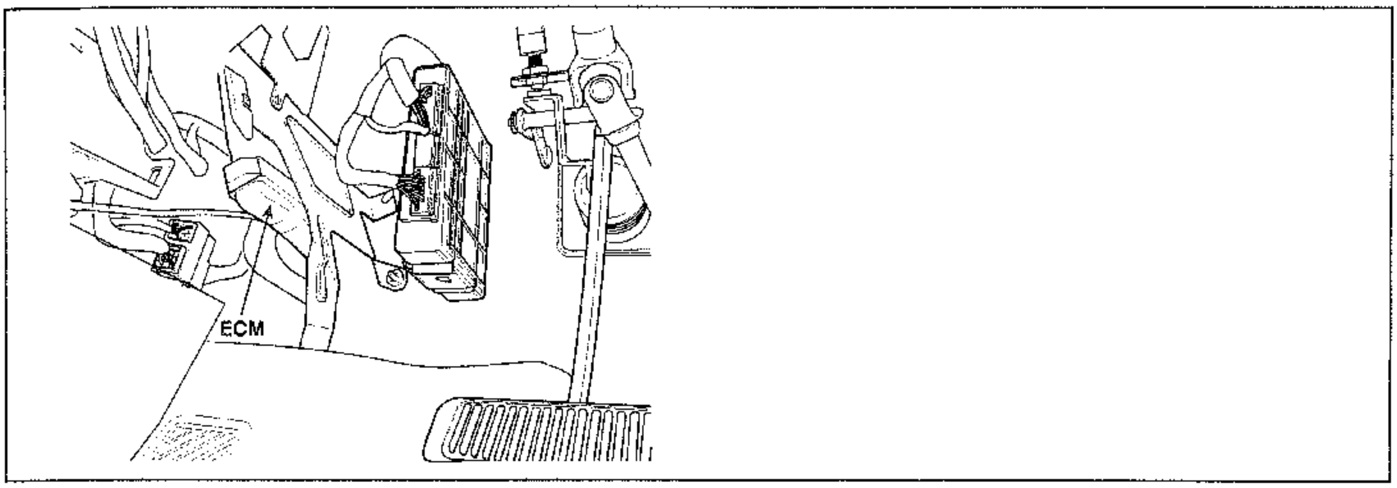
Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

DTC P1638 | MICROCONTROLLER MALFUNCTION

COMPONENT LOCATION E6DCF68A



P1638-1

DESCRIPTION E17C43F6

GENERAL DESCRIPTION

Malfunctions are detected using checksum techniques for verifying data.

Digital data is composed of zeros and ones. A checksum is the total of all ones in a string of data.

By comparing the checksum value with a stored value, a malfunction can be detected.

If an overrun occurs during normal operation, the microcontroller will be monitored when the following test conditions have been fulfiled :

1. Ignition start has not occurred.
2. Accelerator pedal not actuated.
3. Cruise control is not active.
4. No increase in external fuel quantity command.

DTC DESCRIPTION

If the ECM microcontroller generates threshold value, the ECM judged this as a fault and DTC is set.

DTC DETECTING CONDITION EE61AA96

Item	Detecting Condition	Possible Cause
DTC Strategy	• Rationality check	• Faulty ECM
Enable Conditions	• Ignition on	
Threshold Value	• Case 1: microcontroller is reported as defective (recovery occurred (new program start)) • Case 2: injector is energized as engine while engine speed above 2050 rpm and APS is 0 % (fuel cut range) • Case 3: engine speed has not dropped below 500 rpm within 1.5 sec. after turning the iginition switch off (Watchdog post-run test) • Case 4: Gate array communication error occurs	
Diagnostic Time	• Case 1: 0 sec. • Case 2: AT 0.84 sec. MT 0.49 sec. • Case 3: 0 sec. • Case 4: 0.3 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• No • Yes (case3) • Yes (case 1,2,4) • No	

MONITOR DTC STATUS EAA8B8A9

1. Igintion " OFF ".
2. Connect scantool and select Diagnostic Trouble Code(DTC).
3. Clear DTC and then, Monitor DTC status.
4. Is the DTC P1638 is retreived again ?

YES

Substitute with a known-good ECM and check for proper operation.
If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.

NO

Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR ECC2D6A8

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle within DTC Enable conditions in General information.
3. Are any DTCs present ?

YES

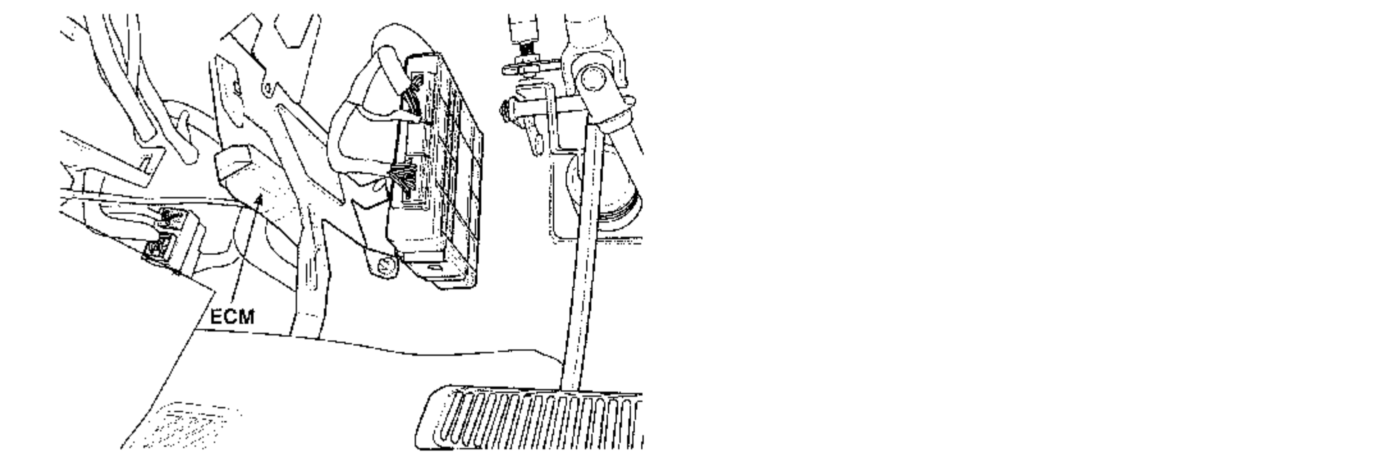
Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

DTC P1639 | A/D CONVERTER MONITORING MALFUNCTION

COMPONENT LOCATION EF52A413



F1639-1

DESCRIPTION EDCFFA2C

GENERAL DESCRIPTION

Intialization of the background test is the first one carried out in the system.

It therefore stsrts in the internal ROM and leads to supervisor identification by testing and initializing the external bus and testing the internal RAM.

Afterwards the external RAM is tested and the checksum of the EPROM is calculated.

After starting, A/D converter with all electric connections are monitored continuously by the ECM.

A checksum is the total of all ones in a string of data.

By comparing the checksum value with a stored value, a malfunction can be detected.

DTC DESCRIPTION

If the ECM A/D converter generates threshold value, the ECM judged this as a fault and DTC is set.

DTC DETECTING CONDITION E2247F30

Item	Detecting Condition	Possible Cause
DTC Strategy	• Rationality check	• Faulty ECM
Enable Conditions	• Ignition on	
Threshold Value	• Case 1: dynamic RAM test failure • Case 2: APS 2 signal is above 200.39 mV when checking the ground connection every 2 second • Case 3: sensor supply voltage is above 5.16 V or below 4.7 V	
Diagnostic Time	• Case 1: 0.1 sec. • Case 2: 0.5 sec. • Case 3: 0.1 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• No • Yes • No • No	
Fail Safe	• Engine speed is fixed at 1200 rpm without the accel position sensor action	

MONITOR DTC STATUS E657A639

1. Igintion " OFF ".
2. Connect scantool and select Diagnostic Trouble Code(DTC).
3. Clear DTC and then, Monitor DTC status.
4. Is the DTC P1638 is retreived again ?

YES

Substitute with a known-good ECM and check for proper operation.
If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.

NO

Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E1D8DCCC

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle within DTC Enable conditions in General information.
3. Are any DTCs present ?

YES

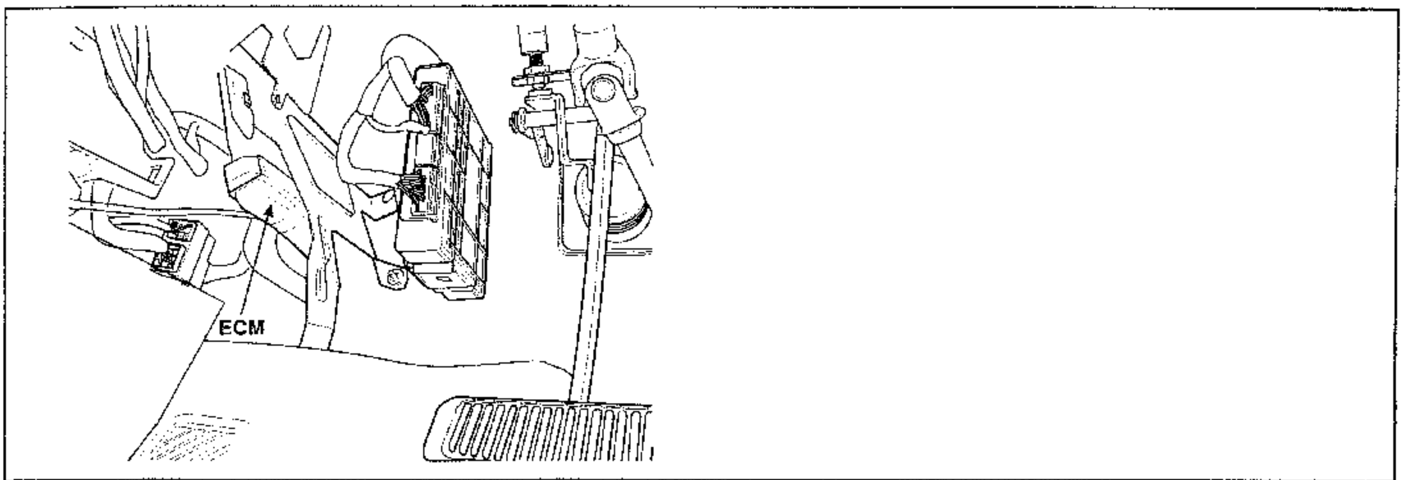
Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

DTC P1646 | CAPACITOR VOLTAGE MALFUNCTION-BOOSTER VOLTAGE TOO HIGH

COMPONENT LOCATION E6B85BC1



P1646-1

DESCRIPTION EAABC85E

GENERAL DESCRIPTION

Special injectors with hydraulic servo-system and electrical triggering (solenoid valve) are used with common rail system in order to archieve efficient start of injection and precise fuel injection quantity.

The nozzle has opened by the electrical pulse, the energizing current is reduced to a lower holding value.

The Injection terminates when the solenoid valve is no longer triggered and closes as result.

The switching on the ECM, the current profile of the injector with booster, clear, and recharge phases is the following step. Capacitor in ECM is function to charge for activating the injectors ① Capacitor discharge → ② Pull up current → ③ Charge (7A) → ④ Hold in current (12±1A) → ⑤ Charge (⑥,⑦ Hold in control current).

DTC DESCRIPTION

If the signal above threshold value, the ECM judged this as a fault and DTC is set.

DTC DETECTING CONDITION E4BD76DD

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal check, high	• Faulty ECM
Enable Conditions	• Engine run	
Threshold Value	• Injector booster voltage > 95 V (More than 7 times)	
Diagnostic Time	• 0 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• No • No • Yes • No	

MONITOR SCANTOOL DATA E94DB361

1. Connect scantool to Data Link Cable (DLC).
2. Monitor " Injector Booster Operating Voltage " parameter on the scantool.

FIG 1

1.2 CURRENT DATA

*	MASS AIR FLOW	473 mg/st
*	FUEL PRESSURE	276.8bar
*	FUEL PRESS. REGULATOR	16.5 %
*	BOOSTER V-OPERAT'G INJ	77.8 V
*	FUEL QUANTITY	8 mcc
	ACCEL.POSITION SENSOR	718.5mV
	COOLANT TEMP. SENSOR	83.9 °C
	ENGINE SPEED	752 rpm

FIX | SCRN | FULL | PART | GRPH | HELP

Fig 1) Normal value with injector booster operating voltage sensor at idle.

Is Current data displayed correctly ?

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Substitute with a known-good ECM and check for proper operation.

If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR ED339A71

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle within DTC Enable conditions in General information.
3. Are any DTCs present ?

YES

Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

DTC P1647 | CAPACITOR VOLTAGE - TOO LOW

COMPONENT LOCATION EFE009E4

Refer to DTC P1646.

DESCRIPTION EE4A1DF7

GENERAL DESCRIPTION

Refer to DTC P1646.

DTC DESCRIPTION

If the signal is below threshold value, the ECM judged this as a fault and DTC is set.

DTC DETECTING CONDITION EBDADC91

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal check, low	• Faulty ECM
Enable Conditions	• Engine run	
Threshold Value	• Injector booster voltage < 10 V (More than 7 times)	
Diagnostic Time	• 0 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• No • No • Yes • No	

MONITOR SCANTOOL DATA ECBA6AFF

Refer to DTC P1646.

VERIFICATION OF VEHICLE REPAIR E195CF05

Refer to DTC P1646.

DTC P1661 | CRUISE CONTROL LAMP-OPEN OR SHORT CIRCUIT

COMPONENT LOCATION ED298604

Refer to DTC P0564.

DESCRIPTION EA393CAF

GENERAL DESCRIPTION

The cruise control system keeps the vehicle running at a fixed speed until a signal canceling this fixed speed is receive-d.

When the main switch "AUTO CRUISE" is turned on with vehicle in the running mode, the battery voltage is applied to the ECM. When a signal from the control switch is input to the ECM while the vehicle is in state, the cruise control actu-ator is activited to operate the system.

Also, while the system is operating, "AUTO CRUISE" indicator lamp in the meter assembly lights up.

In case of the cruise control system failure, the engine symptoms will occur acceleration failure and vehicle speed sett-ing failure.

DTC DESCRIPTION

If the signal exceeds threshold value, the ECM judges this as a fault and DTC is set.

DTC DETECTION CONDITION E62E01B9

Item	Detecting Condition	Possible Cause
DTC Strategy	• Votage check, low or high	• Open or short in cruise control circuit • Faulty cruise control switch • Faulty ECM
Enable Conditions	• Engine run	
Threshold Value	• Case 1 : Short for cruise control lamp circuit. • Case 2 : Open for cruise control lamp circuit.	
Diagnostic Time	• Case 1 : 0.5 sec • Case 2 : 1.2 sec	
MIL Fuel Limit Fuel Cut EGR Off	• No • No • No • No	

SCHEMATIC DIAGRAM E9EC19BB

Refer to DTC P0564.

TERMINAL AND CONNECTOR INSPECTION E3AED6BB

1. Many malfunctions in the electrical system are caused by poor harness and terminals.
   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

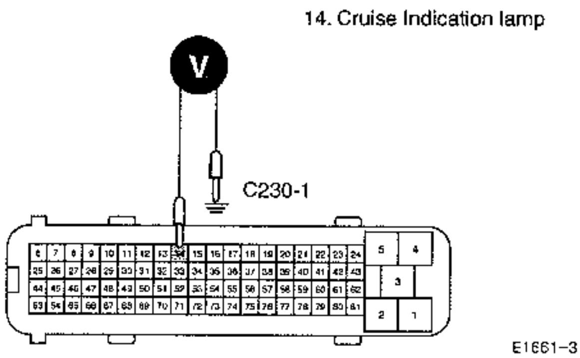
NO

Go to "Control Circuit Inspection" procedure.

CONTROL CIRCUIT INSPECTION E81E043D

1. Ignition "OFF" & Engine "OFF".
2. Disconnect ECM connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 14 of ECM harness connector and chassis ground.

Specification : Approx. 10.8 ~ 13.0V



5. Is the measured voltage within specifications ?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Check for open or short in control harness.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E404EA47

1. Check Cruise control indication lamp
   1) Ignition "ON" & Engine "OFF".
   2) Disconnect ECM connector.
   3) Jump terminal 24 of ECM harness connector and chassis ground with jumper wire.
   4) Is the Cruise control indication lamp turned ON ?

   YES

   ▶ Go to "Check bulb" as below.

   NO

   ▶ Check for open or short in signal harness.
   Repair as necessary and go to "Verification vehicle Repair" procedure.
2. Check Bulb
   1) Ignition "OFF" & Engine "OFF".
   2) Remove Instrument Panel and then remove bulb from instrument panel.
   3) Apply 12 voltage to the bulb and check that bulb is turned ON.
   4) Is the bulb turned ON ?

   YES

   ▶ Substitute with a known-good ECM and check for proper operation.
   If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.

   NO

   ▶ Substitute with a known-good bulb and check for proper operation.
   If the problem is corrected, replace bulb and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR ED69E13A

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle within DTC Enable conditions in General information.
3. Are any DTCs present ?

YES

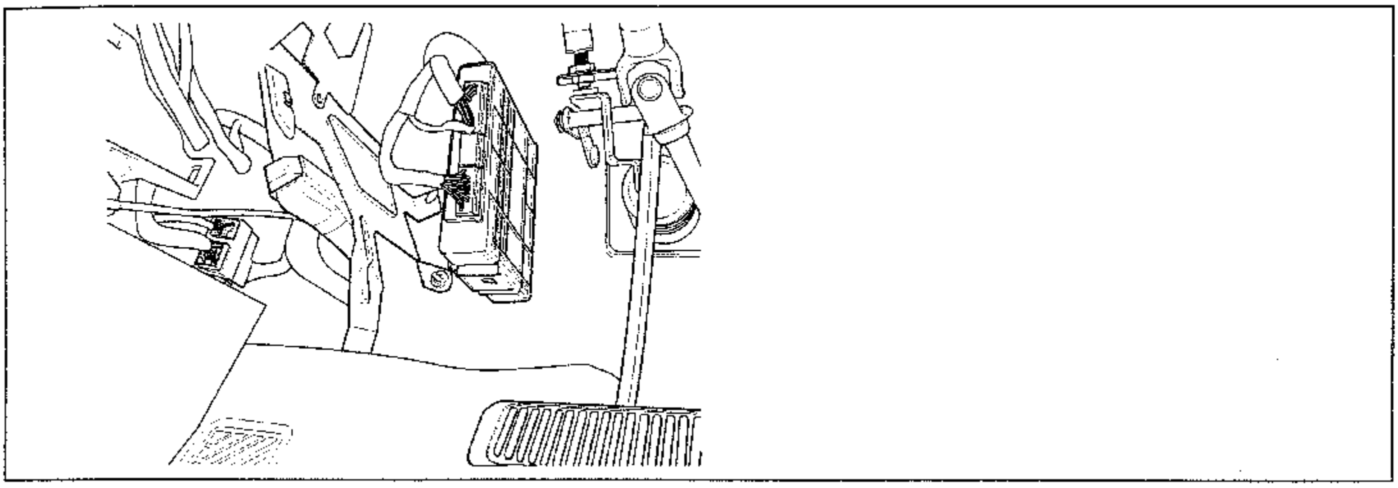
Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

DTC P1765 | TORQUE REDUCTION SIGNAL - MAL

COMPONENT LOCATION EF83094F



P1765-1

DESCRIPTION E40C564C

GENERAL DESCRIPTION

The ECM communicate over the CAN are the EMS(Engine Management System), TCS(Traction Control System) TCM-(Transmission Control Moudle). With the introduction of a CAN, only two Lines are required to achieve the same function. The information is in digital format . This method does not use a integrated ECM.

Input signals to TCM through " CAN communication " are as follows.

▶ Engine rpm, TPS signal, A/C signal, WTS signal, AFS signal, Vss signal, Shift holding signal (FTCS ON).

Output signals from TCM through " CAN communication " are as follows.

▶ Request signal for torque reduction, ATF temperature, TCM type, TCM error or not, damper clutch on, off/gear position.

In case of the CAN failure, the engine symptoms will occur the corrupted torque reduction signal information, shift shock and increasing engine rpm abruptly.

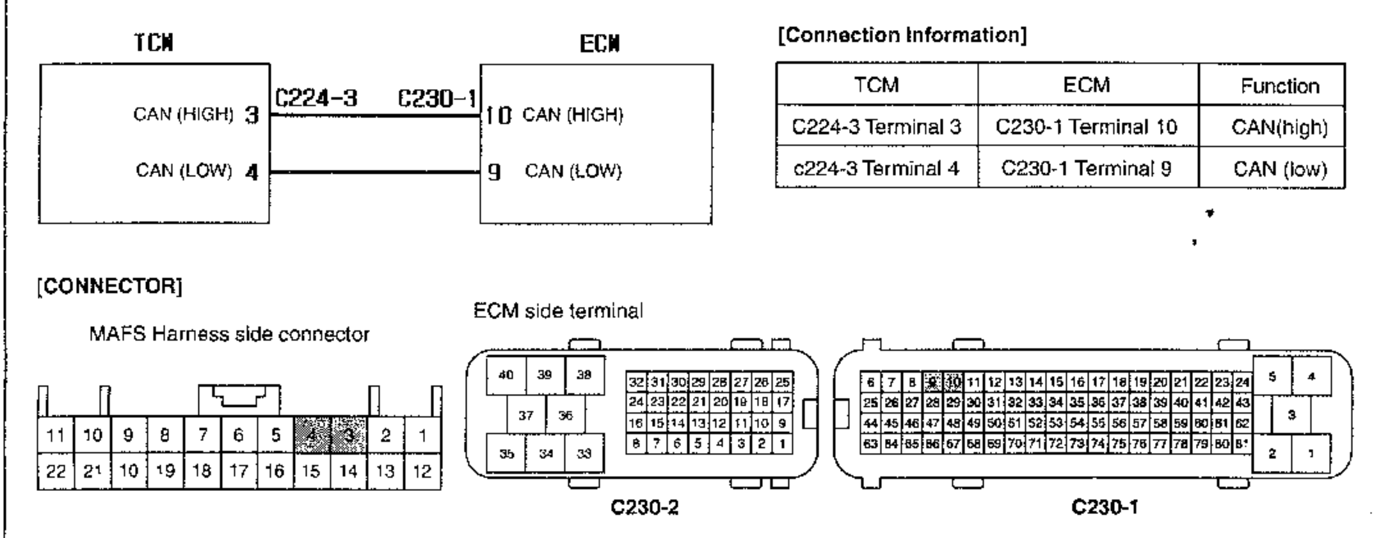
DTC DESCRIPTION

If the CAN communication generates threshold value, the ECM judges this as a fault and DTC is set.

DTC DETECTION CONDITION EA912C54

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal check, low	• Faulty ECM
Enable Conditions	• Ignition on	
Threshold Value	• Torque reduction signal < 200 Nm from TCM to ECM	
Diagnostic Time	• 5 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• No • No • No • Yes	

SCHEMATIC DIAGRAM E3CE31DE

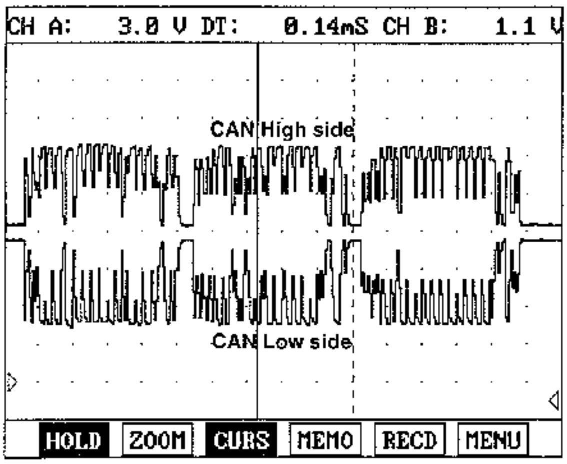


[Connection Information]

TCM	ECM	Function
C224-3 Terminal 3	C230-1 Terminal 10	CAN(high)
c224-3 Terminal 4	C230-1 Terminal 9	CAN (low)

E1765-2

SIGNAL WAVEFORM EEEAE9DD



This test should be inspected after depressing the HOLD mode while idling.
In this CAN communication signal waveform, it is impossible to read through by displaying the scantool.
If unstable waveform pattern with non-uniform frequency or no signal, replace the ECM or the TCM after checking the wiring harness.

E1765-3

MONITOR DTC STATUS EBB12671

1. Connect scantool to Data Link Connector(DLC).
2. Warm up the engine to normal operating temperature.
3. Monitor that DTC P1765 is retrieved on scantool.
4. Is the DTC P1765 is retrieved on scantool ?

YES

▶ This is problem with automatic transaxle. Go to Automatic transaxle troubleshooting procedure.

NO

▶ Fault is intermittent caused by poor contact in the ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EFEFFC7B

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle within DTC Enable conditions in General information.
3. Are any DTCs present ?

YES

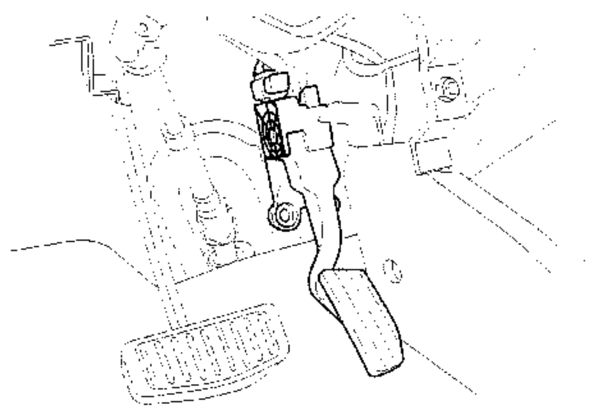
Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

DTC P2135 | ACCELERATION POSITION SENSOR 2 - RANGE/ PERFORMANCE

COMPONENT LOCATION ED5B7A88



E2135-1

DESCRIPTION E086A897

GENERAL DESCRIPTION

APS(Acceleration Position Sensor) is measured the driver's acceleration using a potentiometer and APS signal is transmitted to the ECM. The pedal's position is calculated from the voltage of potentiometer in the APS.

The absence of a mechanical link between the accelertor pedal and injection system presents a risk of loss of control of the engine in the event of a failure of the component in the charge of providing the driver's request information to the injection system.

Therefore, APS has the two potentiometers whose slides are mechanically solid.

APS 1 decides to the fuel quantity and injection timing in the engine.

DTC DESCRIPTION

If the signal exceeds threshold value, the ECM judges this as a fault and DTC is set.

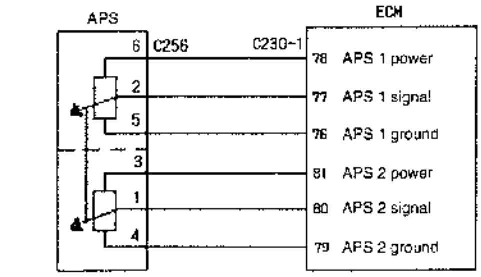
DTC DETECTION CONDITION E5F76DF1

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal check, high	• Short in signal circuit of APS1 & 2 • Open in signal circuit of APS1 & 2 • Open in ground circuit of APS1 & 2 • Faulty APS 1 • Faulty APS 2 • Faulty ECM
Enable Conditions	• Ignition on	
Threshold Value	• APS 1 - APS 2 is above 1.232 mV when the APS1 and APS2 signal is below 1.2% • APS 1 - APS 2 is above 308 mV when the APS1 and APS2 signal is from 1.8 % to 1.6% • APS 1 - APS 2 is above 406 mV when the APS1 and APS2 signal is above 7 %	
Diagnostic Time	• 2.4 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• Yes • Yes • No • No	
Fail safe	• Engine speed is fixed at 1200 rpm without accel pedal sensor action. • Engine performance is reduced. • Air conditioning system is deactivited as against the vehicle speed and the engine rpm. • Cruise control system inhibited.	

SPECIFICATION ETFC33AB

APS		
Accel pedal position	Idle Position (0%)	Fully acceleration (100%)
Signal votage	0.2 ~ 0.5 V	1.6 ~ 2.5 V

SCHEMATIC DIAGRAM ECB1410D



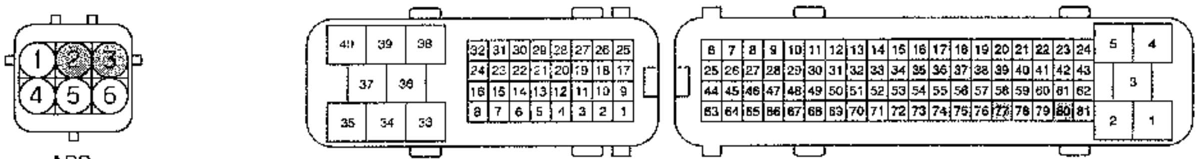
[Connection Information]

1	C230-1 Terminal 76	APS 1 ground
2	C230-1 Terminal 77	APS 1 signal
3	C230-1 Terminal 78	APS 1 power
4	C230-1 Terminal 79	APS 2 ground
5	C230-1 Terminal 80	APS 2 signal
6	C230-1 Terminal 81	APS 2 power

[CONNECTOR]

APS Harness side connector

ECM side terminal



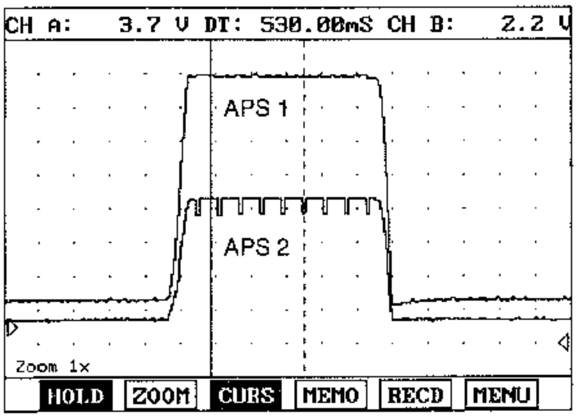
APS

C230-2

C230-1

E2135-2

SIGNAL WAVEFORM E8DCE9A4



This test should be inspected after depressing the HOLD mode from run after the sudden acceleration.
As accel pedal is pressed down fully, the intensity of the APS 1 & 2 waveform increases individually.
APS 1 signal voltage is less than 1V to over 4V and APS 2 is 1/2 voltage as against APS 1 voltage.
The waveform pattern become increasing upward rapidly when the engine speed increases.

E2135-3

MONITOR SCANTOOL DATA E37DB82F

1. Connect scantool to Data Link Cable (DLC).
2. Warm up engine to normal operating temperature.
3. Monitor "Acceleration Position Sensor" parameter on the scantool.

FIG 1

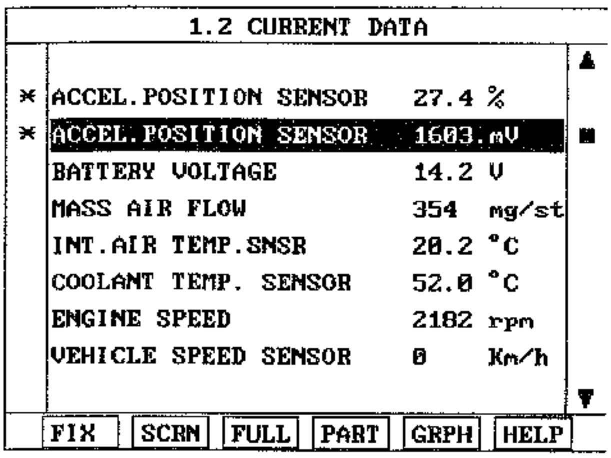


Fig 1) Signal increases when depressing accel pedal.

Is the Current data displayed correctly ?

YES

Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "W/Harness Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION EF62FC29

1. Many malfunctions in the electrical system are caused by poor harness and terminals.
   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

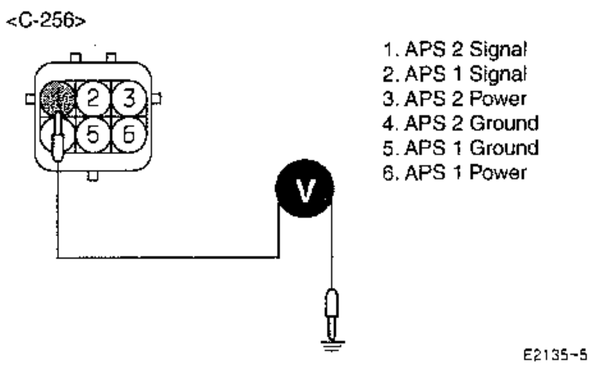
NO

Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION EBAFA188

1. Check for open or short in APS 2 Signal harness
   1) Ignition "OFF".
   2) Disconnect APS sensor connector.
   3) Ignition "ON" & Engine "OFF".
   4) Measure voltage between terminal 1 of the sensor harness connector and chassis ground

Specification : 4.8 ~ 5.1V



   5) Is the measured voltage within specifications ?

YES

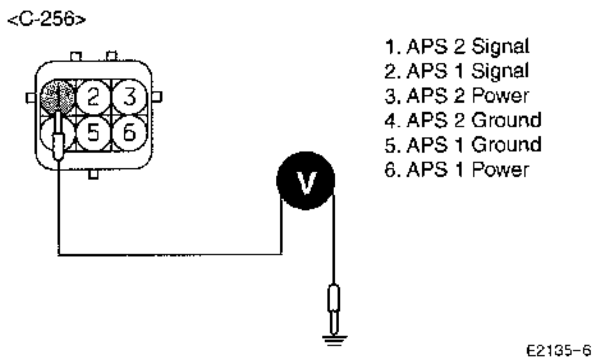
▶ Go to "Check for open or short in APS1 Signal harness" as below.

NO

▶ Check for open or short in APS2 signal harness. Repair as necessary and go to "Verification vehicle Repair" procedure.

2. Check for open or short in APS1 signal harness
   1) Ignition "OFF"
   2) Disconnect AP sensor connector
   3) Measure voltage between terminal 2 of the sensor harness connector and chassis ground.

Specification : 4.8 ~ 5.1V



   4) Is the measured voltage within specifications ?

YES

▶ Go to "Ground Circuit Inspection" procedure.

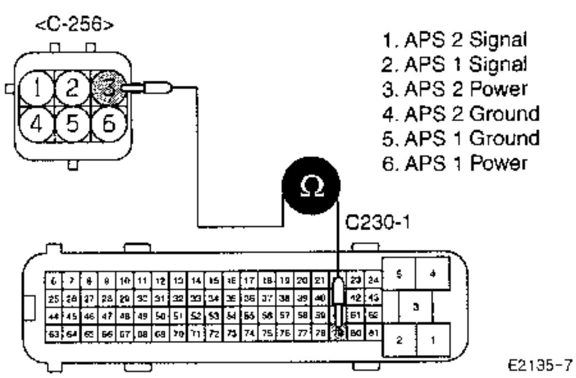
NO

   5) ▶ Check for open or short in APS1 harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION EA7ABECD

1. Check for open in APS2 harness.
   1) Ignition "OFF".
   2) Disconnect AP sensor and ECM connector.
   3) Measure resistance between terminal 4 of the sensor harness connector and terminal 79 of ECM harness connector

Specification : Approx.below 1Ω



4) Is the measured resistance within specifications ?

YES

▶ Go to "Check for open in APS1 ground harness" as below.

NO

▶ Check for open in APS2 ground harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

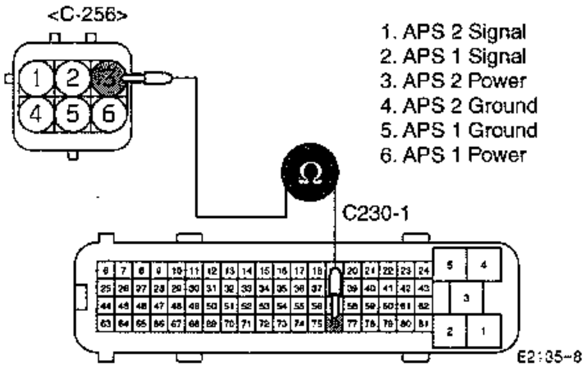
2. Check for open in APS1 harness

1) Ignition "OFF".

2) Disconnect AP sensor and ECM connector.

3) Measure resistance between terminal 5 of the sensor harness connector and terminal 79 of ECM harness connector.

Specification : Approx.below 1Ω



4) Is the measured resistance within specifications ?

YES

▶ Go to "Component Inspection" procedure.

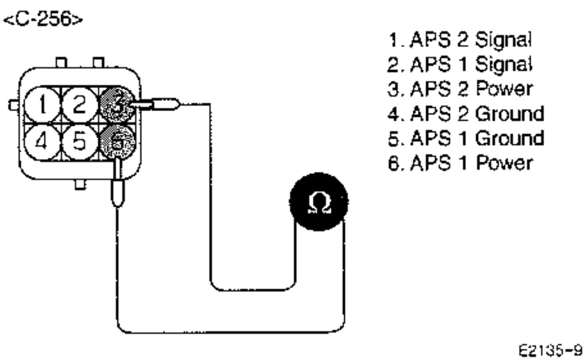
NO

▶ Check for open in APS1 ground harness. Repair as necessary and go to "Verification vehicle Repair" procedure.

COMPONENT INSPECTION EDFAED4F

1. Check APS
   1) Ignition "OFF".
   2) Disconnect APS connector.
   3) Measure resistance between terminals 3 and 6 of the sensor connector(to IAT sensor side).

Specification : 1.7kΩ ± 0.8kΩ (20°C)



   4) Is the measured resistance within specifications ?

YES

▶ Substitute with a known-good ECM and check for proper operation.
If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Substitute with a known-good APS2 and check for proper operation.
If the problem is corrected, replace APS2 and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EECA6CD7

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle within DTC Enable conditions in General information.
3. Are any DTCs present ?

YES

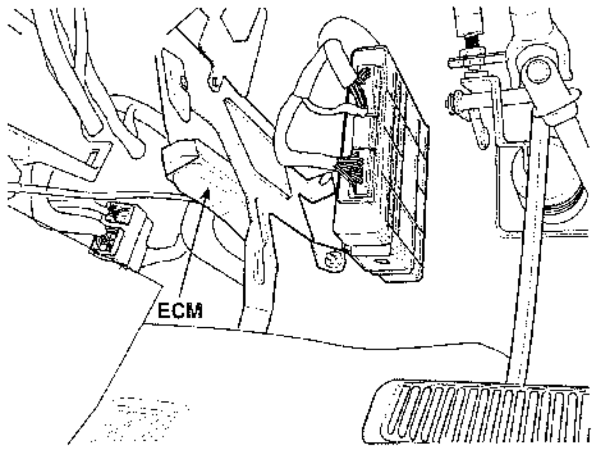
Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

DTC P2228 | ATMOSPHERIC PRESSURE SENSOR - LOW INPUT

COMPONENT LOCATION E424DA53



P2228-1

DESCRIPTION E8588962

GENERAL DESCRIPTION

An atmospheric pressure sensor is used to detect changes in barometric pressure that can alter the intake air density, resulting in improper air-fuel ratio.

To compensate for this type of deviation, the amount of fuel injected is controlled.

For example, the amount of fuel injected is decreased to compensate for the lower intake air density caused by the decreased barometric pressure.(high altitude) The atmospheric pressure sensor is located in the ECM.

DTC DESCRIPTION

If the signal is below threshold value, the ECM judges this as a fault and DTC is set.

DTC DETECTION CONDITION E8D8CDE7

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal check, low	• Faulty ECM
Enable Conditions	• Ignition on	
Threshold Value	• Output signal < 0.15V	
Diagnostic Time	• 2 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• NO • NO • NO • NO	
Fail safe	• Barometric pressure is fixed at a value of 900 hPa by the ECM.	

SPECIFICATION E05D03EE

Atmospheric Pressure SensoR	
Pressure	Approx. 1000 ± 30 hPa

MONITOR SCANTOOL DATA EBAB21E0

1. Connect scantool to Data Link Cable (DLC).
2. Monitor " Barometric Pressure Sensor " parameter on the scantool.

FIG 1

1.2 CURRENT DATA

*	ENGINE SPEED	751 rpm
*	BAROMETRIC PRESS.SNSR	102 kPa
	VEHICLE SPEED SENSOR	0 Km/h
	FUEL PRESSURE	276.8bar
	FUEL PRESS. REGULATOR	16.6 %
	EGR ACTUATOR	95.0 %
	CLUTCH SW.(M/T ONLY)	ON
	BRAKE SWITCH	OFF

FIX | SCRN | FULL | PART | GRPH | HELP

Fig 1) Normal value with barometric pressure sensor sensor at idle speed

Is Current data displayed correctly ?

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Substitute with a known-good ECM and check for proper operation.

If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EAD3BFF3

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle within DTC Enable conditions in General information.
3. Are any DTCs present ?

YES

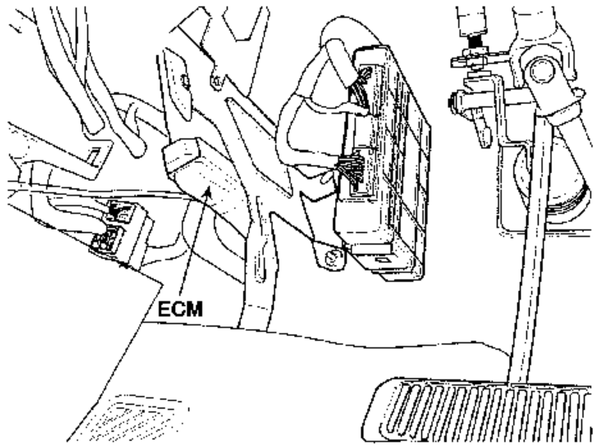
Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

DTC P2229 | ATMOSPHERIC PRESSURE SENSOR - HIGH INPUT

COMPONENT LOCATION E674ED9E



P2228-1

DESCRIPTION E8337C05

GENERAL DESCRIPTION

An atmospheric pressure sensor is used to detect changes in barometric pressure that can alter the intake air density, resulting in improper air-fuel ratio.

To compensate for this type of deviation, the amount of fuel injected is controlled.

For example, the amount of fuel injected is decreased to compensate for the lower intake air density caused by the decreased barometric pressure.(high altitude) The atmospheric pressure sensor is located in the ECM.

DTC DESCRIPTION

If the signal below threshold value, the ECM judges this as a fault and DTC is set.

DTC DETECTION CONDITION E61EDAAA

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal check, low	• Faulty ECM
Enable Conditions	• Ignition on	
Threshold Value	• Output signal < 4.9V	
Diagnostic Time	• 2 sec.	
MIL Fuel Limit Fuel Cut EGR Off	• NO • NO • NO • NO	
Fail safe	• Barometric pressure is fixed at a value of 900 hPa by the ECM.	

SPECIFICATION EF4A9F1A

Atmospheric Pressure Sensor	
Pressure	Approx. 1000 ± 30 hPa

MONITOR SCANTOOL DATA ECDB4DBD

1. Connect scantool to Data Link Cable (DLC).
2. Monitor " Barometric Pressure Sensor " parameter on the scantool.

FIG 1

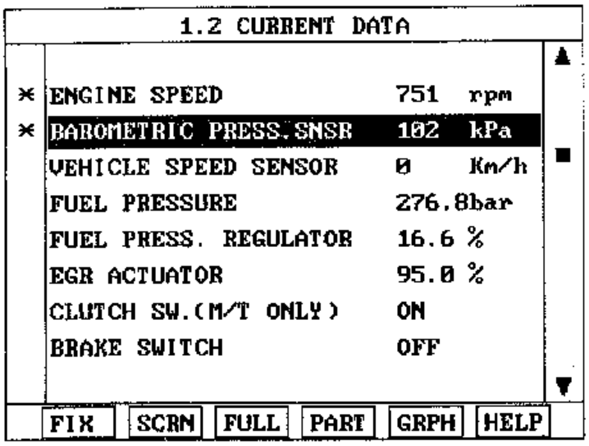


Fig 1) Normal value with barometric pressure sensor sensor at idle speed

Is the Current data displayed correctly ?

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Substitute with a known-good ECM and check for proper operation.

If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EAC913B5

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle within DTC Enable conditions in General information.
3. Are any DTCs present ?

YES

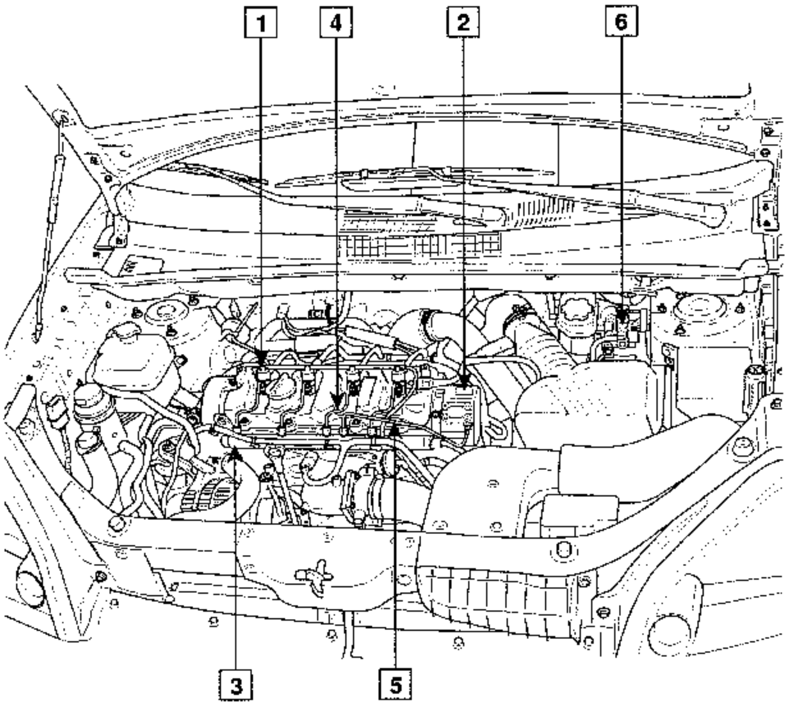
Go to the applicable troubleshooting procedure.

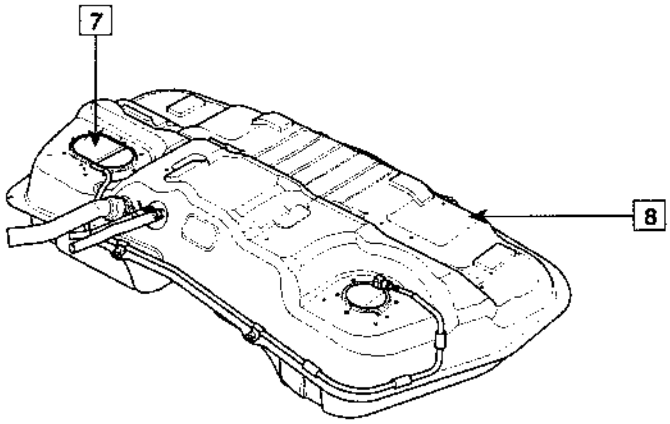
NO

System is performing to specification at this time.

FUEL DELIVERY SYSTEM-DIESEL

COMPONENTS E3963B38





1 Injector
2 High Pressure (HP) Pump
3 Common Rail
4 High Pressure Pipe (Injector←Common Rail)
5 High Pressure Pipe (HP Pump→Common Rail)
6 Fuel Filter
7 Fuel Pump (Low Pressure)
8 Fuel Tank

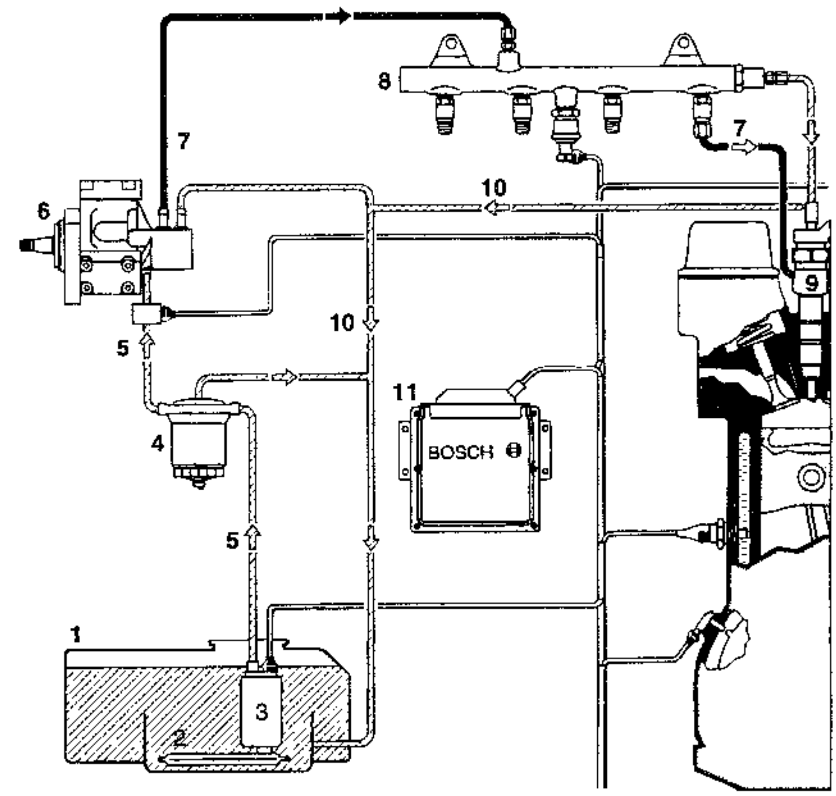
EFQE001C

CAUTION

- Common Rail Fuel Injection System is subject to extremely high pressure (Approximately 1,350 bar)
- Never perform any work on injection system with engine running or within 30 secods after the engine stops.
- Always pay attention to safety precaution.
- Ensure the absolute cleanliness.
- It is not recommanded to remove the injectors without any notice.

FUEL LINE

SCHEMATIC DIAGRAM EE29D937



1. Fuel Tank
2. Pre-filter
3. Fuel Pump (Low pressure)
4. Fuel Filter
5. Low Pressure Fuel Line
6. High Pressure Pump
7. High Pressure Fuel Line
8. Common Rail
9. Injector
10. Fuel Return Line
11. ECM

LWGE004K

LOW PRESSURE FUEL SYSTEM COMPONENTS

FUEL PUMP

The fuel pump is either an electric fuel pump with pre-filter, or a gear-type fuel pump. The pump draws the fuel from the fuel tank and continually delivers the required quantity of fuel in the direction of the high-pressure pump.

FUEL FILTER

Inadequate filtering can lead to damage at the pump components, delivery valves, and injector nozzles. The fuel filter cleans the fuel before it reaches the high-pressure pump, and there by prevents premature wear at the pump's sensitive components.

HIGH PRESSURE FUEL SYSTEM COMPONENTS

HIGH PRESSURE PUMP

The high-pressure pump pressurizes the fuel to a system pressure of up to 1,350bar. This pressurized fuel then passes through a high-pressure line and into the tubular common rail.

COMMON RAIL (HIGH PRESSURE ACCUMULATOR)

Even after an injector has taken fuel from the rail in order to inject it, the fuel pressure inside the rail remains practically constant. This is due to the accumulator effect arising from the fuel's inherent elasticity. Fuel pressure is measured by the rail pressure sensor and maintained at the desired level by the pressure-control valve.

INJECTORS

The nozzles of these injectors open when the solenoid valve is triggered and permit the flow of fuel. They inject the fuel directly into the engine's combustion chamber. The excess fuel which was needed for opening the injector nozzles flows back to the tank through a collector line. The return fuel from the fuel pressure control valve and from the low-pressure stage is also led into this collector line together with the fuel used to lubricate the high-pressure pump.

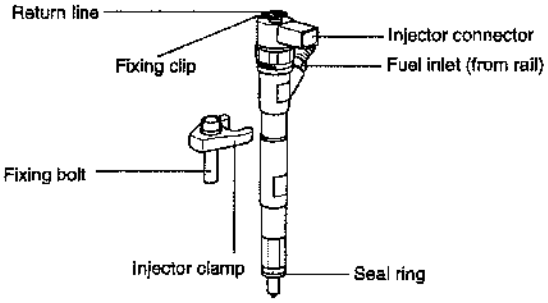
HIGH PRESSURE PIPE

These High Pressure Pipes carry the high-pressure fuel. They must therefore be able to permanently withstand the maximum system pressure and, during the pauses in injection, the sometimes high-frequency pressure fluctuations which occur. They are therefore manufactured from steel tubing. Normally, they have an outside diameter of 6 mm and an internal diameter of 2.4 mm. The injection lines between the common rail and the injectors must all be of the same length. The differences in length between the common rail and the individual injectors are compensated for by using slight or pronounced bends in the individual lengths of tubing. Nevertheless, the injection lines should be kept as short as possible.

INJECTOR

DESCRIPTION EB301E42

The start of injection and the injected fuel quantity are adjusted by electrically triggered injectors. These injectors supersede the nozzle-and-holder assembly (nozzle and nozzle-holder). Similar to the already existing nozzle-holder assemblies in direct-injection (DI) diesel engines, clamps are preferably used for installing the injectors in the cylinder head. This means that the Common Rail injectors can be installed in already existing DI diesel engines without major modifications to the cylinder head.



LWGE680A

- The hole-type nozzle
- The hydraulic servo-system
- The solenoid valve

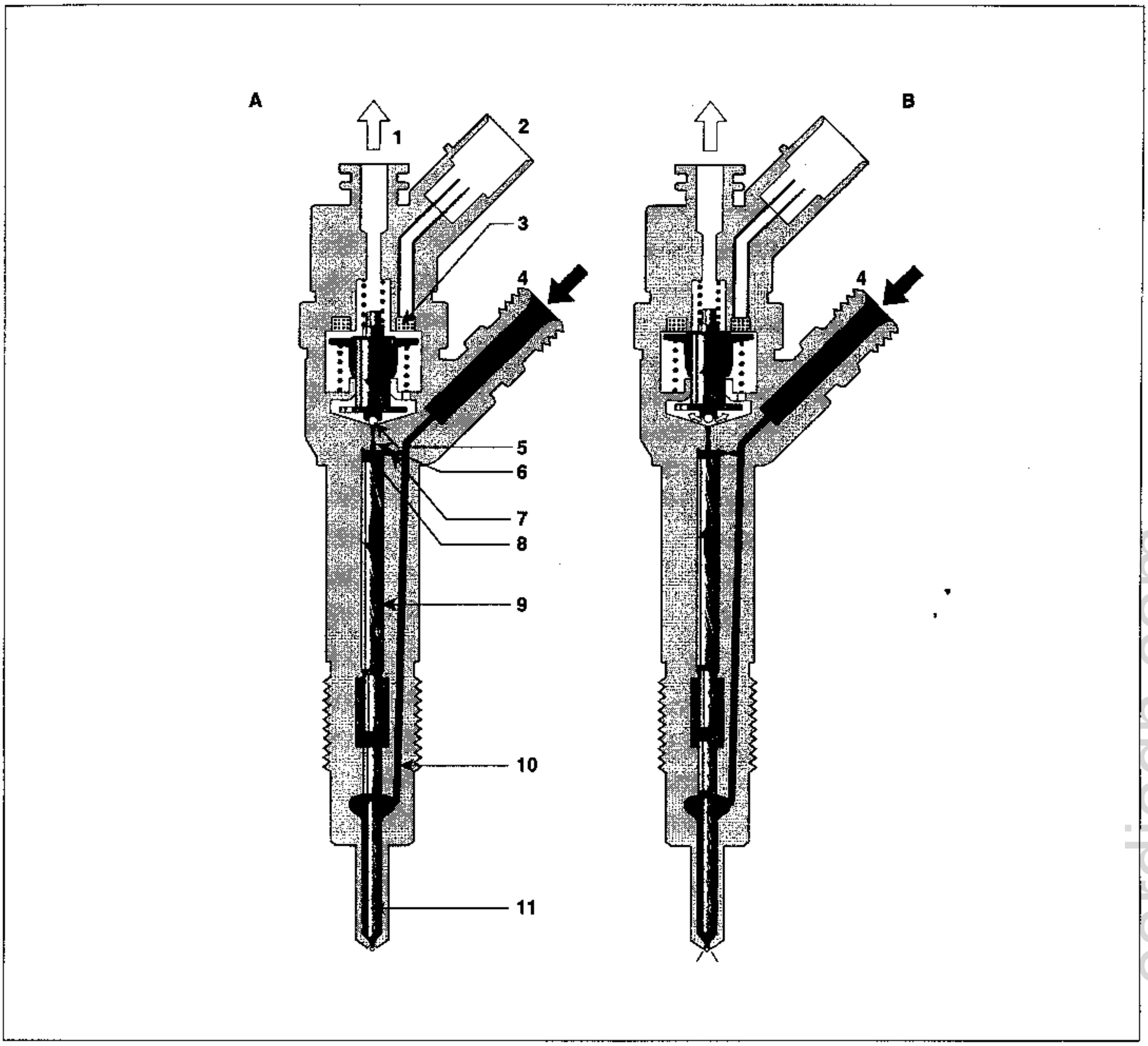
Fuel is fed from the high-pressure connection to the nozzle through the passage,and to the control chamber through the feed orifice. The control chamber isconnected to the fuel return via a bleed orifice which is opened by the solenoidvalve.

With the bleed orifice closed, the hydraulic force applied to the valve controlplunger exceeds that at the nozzle-needle pressure shoulder. As a result,the needle is forced into its seat and seals off the high-pressure passagefrom the combustion chamber.

When the injector's solenoid valve is triggered, the bleed orifice is opened.This leads to a drop in control-chamber pressure and, as a result, the hydraulicpressure on the plunger also drops. As soon as the hydraulic force drops belowthe force on the nozzle-needle pressure shoulder, the nozzle needle opensand fuel is injected through the spray holes into the combustion chamber.This indirect control of the nozzle needle using a hydraulic force-amplificationsystem is applied because the forces which are necessary for opening the needlevery quickly cannot be directly generated by the solenoid valve. The so-calledcontrol quantity needed for opening the nozzle needle is in addition to thefuel quantity which is actually injected, and it is led back to the fuel-returnline via the control chamber's orifices.

In addition to the control quantity, fuel is also lost at the nozzle-needleand valve-plunger guides. These control and leak-off fuel quantities are returnedto the fuel tank via the fuel return and the collector line to which overflow valve, high-pressure pump, and fuel pressure control valve and also connected.

METHODD OF OPERATION E82EF45B



Injector (schematic)

A. Injector closed (at-rest status)
B. Injector opened (injection)
1. Fuel return
2. Electrical connection
3. Triggering element (solenoid valve)
4. Fuel inlet (high pressure) from the rail
5. Valve ball
6. Bleed orifice
7. Feed orifice
8. Valve control chamber
9. Valve control plunger
10. Feed passage to the nozzle
11. Nozzle needle

LWGE261A

The injector's operation can be subdivided into four operating states withthe engine running and the high-pressure pump generating pressure:

1. Injector closed (with high pressure applied)
2. Injector opens (start of injection)
3. Injector opened fully
4. Injector closes (end of injection)

These operating states result from the distribution of the forces appliedto the injector's components. With the engine at stand still and no pressurein the rail, the nozzle spring closes the injector.

1. INJECTOR CLOSED (AT-REST STATUS)

In the at-rest state, the solenoid valve is not energized and is thereforeclosed (See "A" IN Figure). With the bleed orifice closed, the valve springforces the armature's ball ontothe bleed orifice seat. The rail's high pressurebuilds up in the valve control chamber, and the same pressure is also presentin the nozzle's chamber volume. The rail pressure applied at the control plunger'send face, together with the force of the nozzle spring, maintain the nozzlein the closed positionagainst the opening forces applied to its pressure stage.

2. INJECTOR OPENS (START OF INJECTION)

The injector is in its at-rest position. The solenoid valve is energized withthe pickup current which serves to ensure that it opens quickly (See "B" inFigure). The force exerted by the triggered solenoid now exceeds that of thevalve spring and the armature opens the bleed orifice. Almost immediately,the high-level pick-up current is reduced to the lower holding current requiredfor the electromagnet. This is possible due to the magnetic circuit's airgap now being smaller. When the bleed orifice opens, fuel can flow from thevalve-control chamber into the cavity situated above it, and from there viathe fuel return to the fuel tank, The bleed orifice prevents complete pressurebalance, and the pressure in the valve control chamber sinks as a result.This leads to the pressure in the valve-control chamber being lower than thatin the nozzle's chamber causes a reduction in the force exerted on the controlplunger, the nozzle needle opens as a result, and injection starts. The nozzleneedle's opening speed is determined by the difference in the flow rate throughthe bleed and feed orifices. The control plunger reaches its upper stop whereit remains supported by a cushion of fuel which is generated by the flow offuel between the bleed and feed orifices. The injector nozzle has now openedfully, and fuel is injected into the combustion chamber at a pressure almostequal to that in the fuel rail. Force distribution in the injector is similarto that during the opening phases.

3. INJECTOR CLOSES (END OF INJECTION)

As soon as the solenoid valve is no longer triggered, the valve spring forcesthe armature downwards and the ball closes the bleed orifice. The armatureis a 2-piece design. Her, although the armature plate is guided by a drivershoulder in its downward movement, it can "over spring" with the return springso that it exerts no downwards-acting forces on the armature and the ball.This closing of the bleed orifice leads to pressure build up in the controlchamber via the input from the feed orifice. This pressure is the same asthat in the rail and exerts an increased force on the control plunger throughits end face. This force, together with that of the spring, now exceeds theforce exerted by the chamber volume and the nozzle needle closes. The nozzleneedle's closing speed is determined by the flow through the feed orifice.Injection ceases as soon as the nozzle needle comes up against its bottomstop again.

CLEANING EDA171D9

CAUTION

- Common Rail Fuel Injection System is subject to extrembly high pressure (Approximately 1,350 bar)
- Never perform any work on injection system with engine running or within 30 seconds after the engine stops.
- Always pay attention to safety precaution.
- Ensure the absolute cleanliness.
- It is not recommended to remove the injectors without any notice.

It must be needed to clean the injector when injector is used again.

1. Clean the injector in vertical position in an ultra-sound bath.

2. If necessary, clean the injector body and sealing surface on the nozzle retaining nut also, using a fine cleaning cloth to remove any dirt residue.

   Do not remove the protection caps to do that.

3. The nozzle-shaft must only be cleaned in an ultrasound bath and in a vertical position.

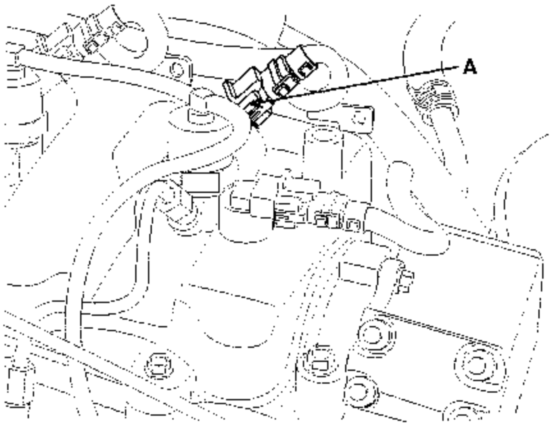
   A mechanical cleaning of the nozzle-shaft by wire-brush is not permitted.

REMOVAL E9C50FD6

CAUTION

- Common Rail Fuel Injection System is subject to extremely high pressure (Approximately 1,350 bar)
- Never perform any work on injection system with engine running or within 30 seconds after the engine stops.
- Always pay attention to safety precaution.
- Ensure the absolute cleanliness.
- It is not recommended to remove the injectors without any notice.

1. Turn ignition swithc to OFF position.
2. Disconnect the negative battery (-) terminal and wait for about 30 seconds.
3. Pull off the injector electric connector (A).

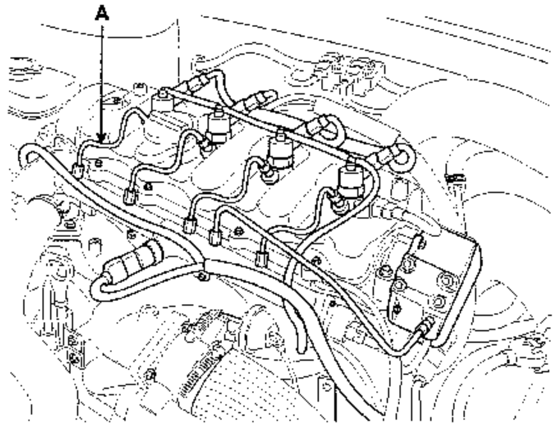


LWGE004L

CAUTION

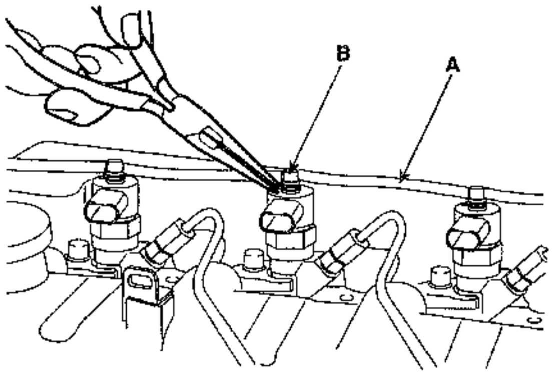
- Plugs must be installed and/or uninstalled only with the ignition switch turned OFF.
- Do not extremely bend or squeeze the cable, do not bring them in contact with sharp edges, and also secure cables against vibrations.

4. Unfasten the high-pressure pipe (A) connecting the common rail and the injector.



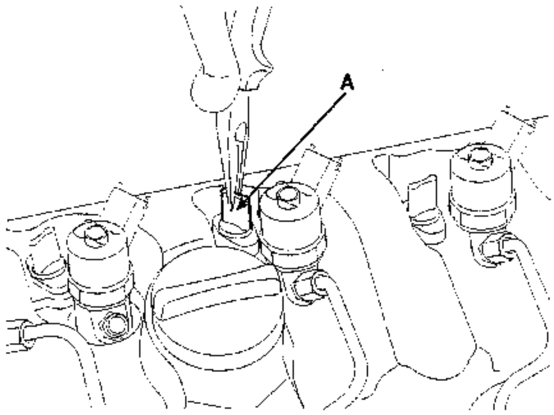
LWGE004M

5. Remove the injector return hose (A) by pulling the fixing-clip (B).



LWGE004N

6. After pulling the injector plug cap (A) vertically, rotate it clockwise and remove it.



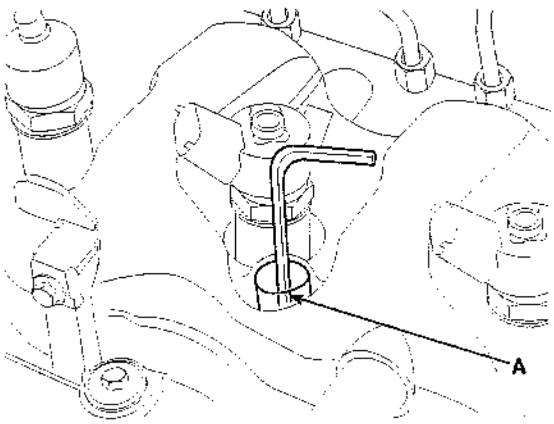
LWGE004O

7. Remove injector by unscrewing injector clamp bolt (A)

⚠ CAUTION

Before re-installing injector, clean the cylinder head bore and sealing surface.

1. Insert the brush.
2. Clean the sealing surface and blow out.



LWGE004P

REPLACEMENT E5455D7B

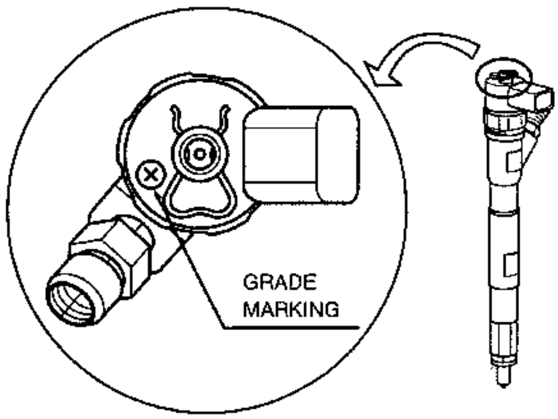
⚠ CAUTION

- Common Rail Fuel Injection System is subject to extremely high pressure (Approximately 1,350 bar)
- Never perform any work on injection system with engine running or within 30 seconds after the engine stops.
- Always pay attention to safety precaution.
- Ensure the absolute cleanliness.
- It is not recommended to remove the injectors without any notice.

1. Remove the injector according to removal procedure.
2. Check the injector grade on top of the injector, and then replace the used injector with a new one in same grade with used one.

NOTE

If it is impossible to replace the used injector with a new injector in same grade, replace it with the new one in different grade according to the table below.



LWGE004Q

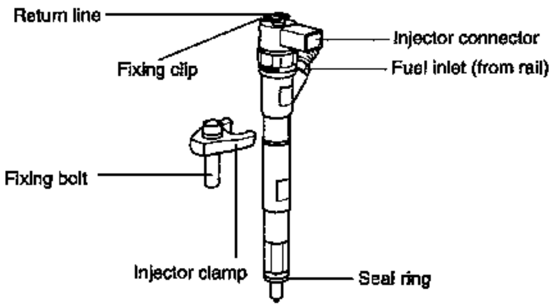
Grade	X	Y	Z
Combination 1	0	4	0
Combination 2	1	3	0
Combination 3	0	3	1
Combination 4	1	2	1
Combination 5	2	2	0
Combination 6	0	2	2

INSTALLATION EACB2C7C

CAUTION

- Common Rail Fuel Injection System is subject to extremely high pressure (Approximately 1,350 bar)
- Never perform any work on injection system with engine running or within 30 seconds after the engine stops.
- Always pay attention to safety precaution.
- Ensure the absolute cleanliness.
- It is not recommended to remove the injectors without any notice.

1. Insert the new seal ring.



LWGE680A

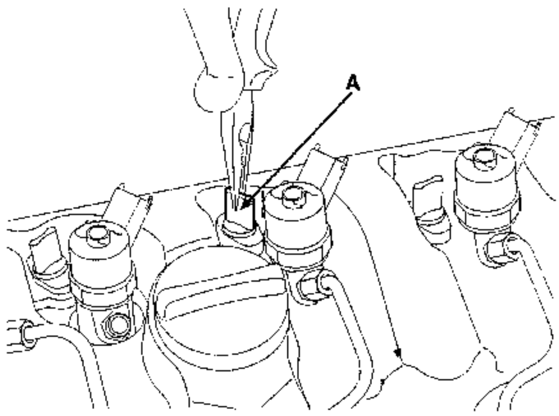
CAUTION

- Whenever using the old injector again, the clamp fixing bolt and seal-ring are replaced with a new one.
- Before re-installing injector, clean the cylinder head bore and sealing surface.

2. Insert the injector assembly into the cylinder block. At this time, do not touch the nozzle tip.
3. Spread oil on the injector tip and the cylinder head.
4. Install the injector by installing the clamp with clamp bolt.

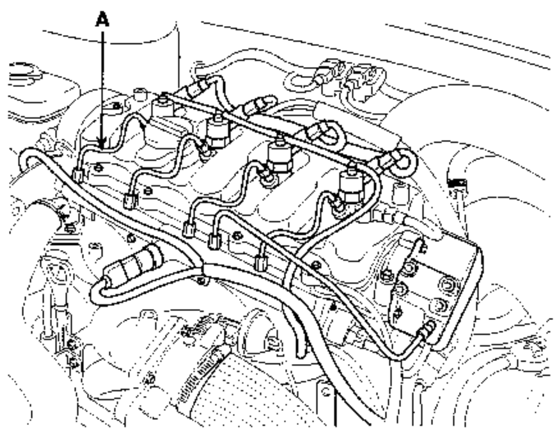
Tightening Torques
Injector Clamp Bolt installation :
25 ~ 29 N·m (18.44 ~ 21.39 lb·ft)

5. Install the injector plug cap (A) by rotating it counter clockwise.



LWGE004O

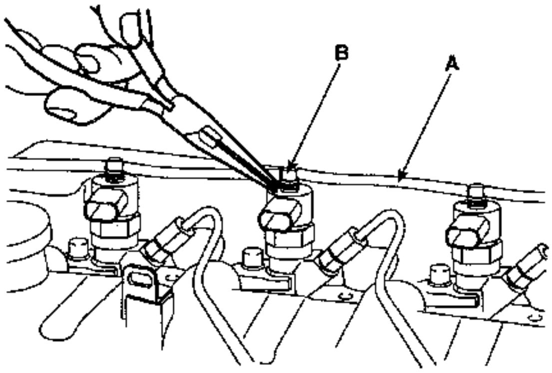
6. Install the high pressure pipe (A) connecting the injector and the common rail.



LWGE004M

Tightening Torques
High Pressure Pipe installation nut :
25 ~ 29 N·m (18.44 ~ 21.39 lb·ft)

7. Connect the return hose (A) by inserting the fixing clip (B).

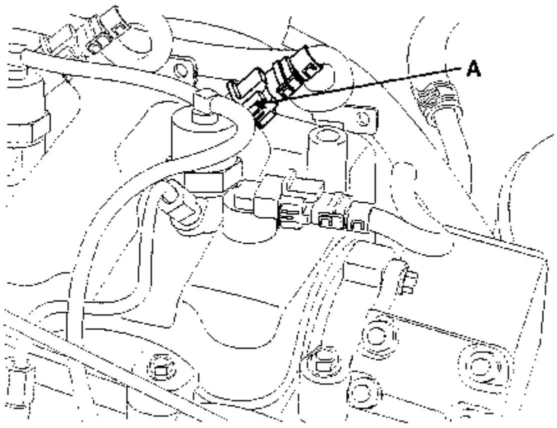


LWGE004N

CAUTION

Afixing clip that was removed must be replaced with a new one.

8. Connect the injector electric connector (A).



LWGE004L

9. Connect the battery (-) cable.

10. Start the engine and check for leakage on high pressure fuel line.

CAUTION

Check the fuel-system visually for any leakage. If a leakage is detected even have been used the correct torque, the component(s) must be exchanged.

INSPECTION EC8F4A8D

USING HI-SCAN(PRO)

- COMPRESSION TEST
- IDLE SPEED COMPARISON
- INJECT QUANTITY COMPARISON

TEST PROCEDURE

1. Connect Hi-Scan(Pro) and select "Vehicle" and "Engine Test Function".

1. HYUNDAI VEHICLE DIAGNOSIS

MODEL : TUCSON
SYSTEM : ENGINE(DIESEL)
WGT
01. DIAGNOSISTIC TROUBLE CODE
02. CURRENT DATA
03. FLIGHT RECORD
04. ACTUATION TEST
05. SIMU-SCAN
06. IDENTIFICATION CHECK
07. ENGINE TEST FUNCTION
08. DATA SETUP(UNIT CONV.)

EFQE660T

2. Information for ECM version is displayed as below.

1.7. COMPRESSION TEST

SYSTEM IMFORMATION
P/N : 39100-27920
S/W : 86S2MDV8

This function is available

If you ready, press [ENTER].

<Available system>

1.7. COMPRESSION TEST

SYSTEM IMFORMATION
P/N : 39100-27920
S/W : 86S2MDV8

This function is not available.
Not all ECM version support
this function
If you ready, press [ENTER].

<Not available system>

EFBC660B

3. After pressing "[ENTER]" select "COMPRESSION TEST" mode and press "[ENTER]".

1.7. COMPRESSION TEST

01. COMPRESSION TEST
02. IDLE SPEED COMPARISON
03. INJECT. QUANTITY COMPARISON

EFBC660D

4. Set the test condition described as below screen and then, crank engine. When engine stop message being appeared, stop cranking.

7.1. COMPRESSION TEST
This test is used for detecting cylinder specific engine speed without injection. * Test condition - Shift lever : P or N - Engine : Stop (IGN. ON) - Electrical Load : OFF If you ready, now cranking, and stop cranking when stop message appear on the screen. Press [ENTER].

EFBC660E

5. Press "ANAL" and the test result is appeared.

7.1 COMPRESSION TEST

Cylinder engine speed(RPM)

#1	#2	#3	#4
356	355	355	355
356	356	357	356
356	356	356	355
356	356	356	356
357	356	355	356
356	355	355	355
355	356	355	355

ANAL

When the stop message appear, stop cranking.

EFBC660F

NOTE

During cranking engine does not start.

7.1 COMPRESSION TEST

Cylinder engine speed(RPM)

#1	#2	#3	#4
356	355	355	355
356	356	357	356
356	356	356	355
356	356	356	356
357	356	355	356
356	355	355	355
355	356	355	355

◀ ▶ AVG HELP

Data scanning button

EFBC660G

6. Press "AVG" and the data average of each cylinder is appeared.

Press "HELP" and description of the data is appeare-d.

Cylinder engine speed(RPM)

Speed(RPM) 200 250 300 350	AvG
#1 CYL.	355
#2 CYL.	355
#3 CYL.	355
#4 CYL.	355

PREV HELP

7.1 COMPRESSION TEST
*The higher cylinder engine speed: - >The low compression pressure. *It can help to identify the mechanical defects.

PREV

EFBC660H

7. After pressing "ESC", select "IDLE SPEED COMPARISON" and press "[ENTER]".

7.1 COMPRESSION TEST

01. COMPRESSION TEST
02. IDLE SPEED COMPARISON
03. INJECT. QUANTITY COMPARISON

EFQE002A

8. Set the test condition described as below screen and press "[ENTER]".

7.2. IDLE SPEED COMPARISON

This test is used for detecting cylinder specific engine speed with injector energizing.
(Cylinder balancing function is deactivated.)

* Test condition
  - Compression test : Normal
  - Shift lever : P or N
  - Engine : Idle
  - Electrical Load : OFF

If you ready, Press [ENTER].

EFBC660J

9. The rpm data of each cylinder is appeared.

7.2 IDLE SPEED COMPARISON

Cylinder engine speed(RPM)

#1	#2	#3	#4
790	800	752	770
796	798	756	772
794	800	752	770
794	802	754	772
794	802	754	770
794	802	756	774
792	802	752	772

Analyze the test result.

ANAL

7.2 IDLE SPEED COMPARISON

Cylinder engine speed(RPM)

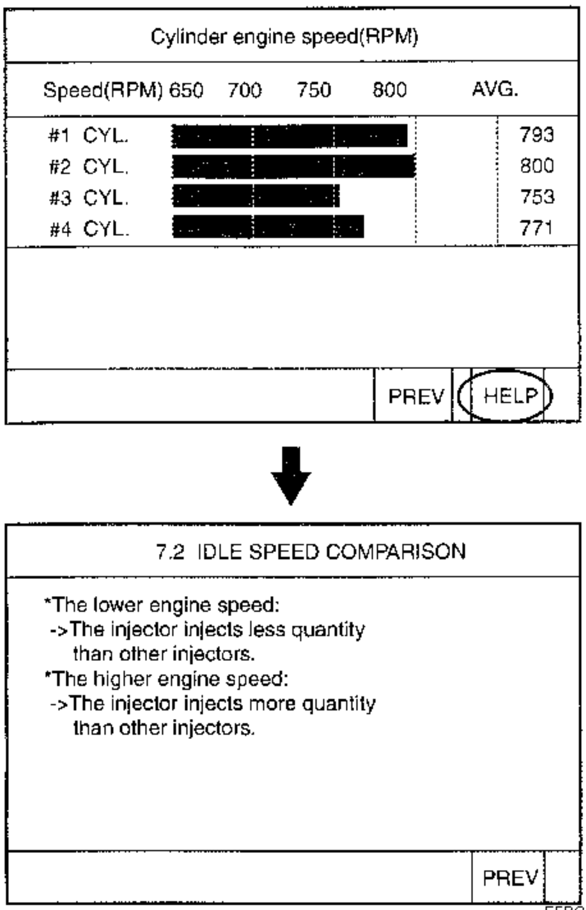
#1	#2	#3	#4
784	774	788	764
786	778	788	766
786	776	788	766
788	780	790	768
784	776	786	764
788	780	792	770
786	776	788	766

◄ ► AVG HELP

EFBC660K

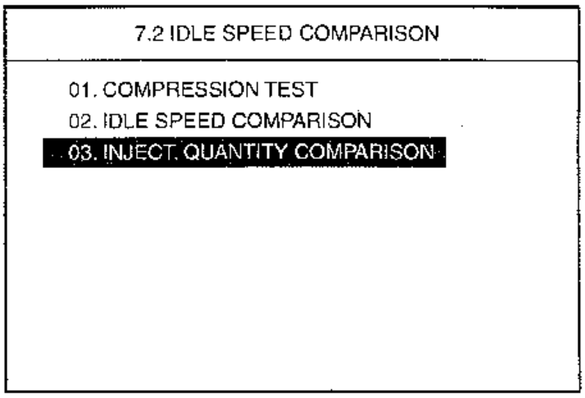
10. Press "AVG" and teh data average of each cylinder is appeared.

    Press "HELP" and description of the data is appeare-d.



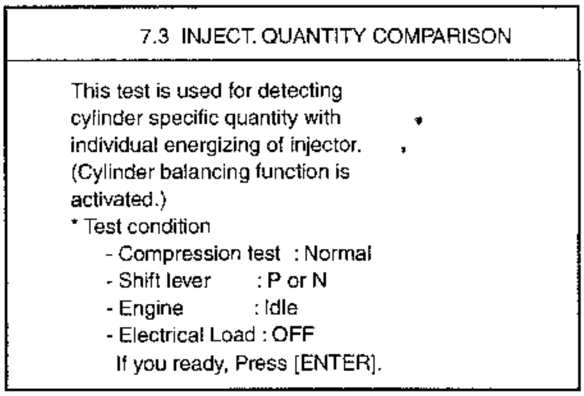
EFBC660M

11. After pressing "ESC", select "INJECT QUANTITY COMPARISON" and press "[ENTER]".



EFQE001A

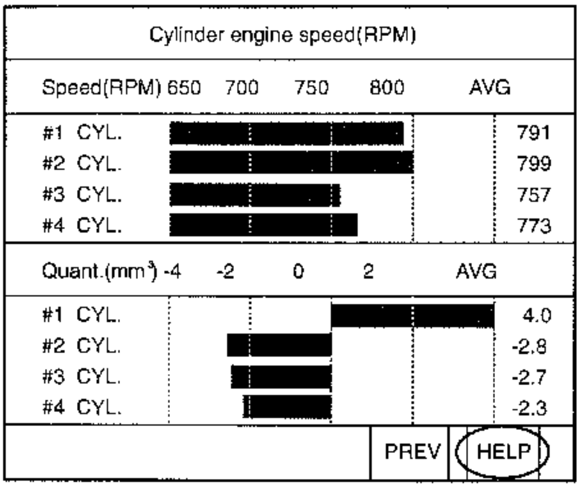
12. Set the test condition described as below screen and press "[ENTER]".



EFBC660O

13. The data of each cylinder about RPM and compensating injection quantity is appeared.

7.3 INJECT. QUANTITY COMPARISON							
Eng. Speed(RPM)				Injection quantity(mm3)			
#1	#2	#3	#4	#1	#2	#3	#4
792	800	758	774	4.0	-2.9	-2.8	-2.4
788	798	760	774	4.0	-2.9	-2.7	-2.4
794	802	758	776	4.0	-2.9	-2.7	-2.4
792	798	758	774	4.0	-2.8	-2.7	-2.4
788	798	758	772	4.0	-2.8	-2.6	-2.4
794	802	758	772	4.0	-2.8	-2.8	-2.5
790	798	754	770	4.0	-2.9	-2.8	-2.5
Analyze the test result.							
ANAL							



<Abnormal state>

EFBC650P

14. Press "HELP" and description of the data is displayed as below.

7.3 INJECT. QUANTITY COMPARISON
*The positive correction value: ->The fuel injection of the cylinder is less than that of other cylinder. *The negative correction value: ->The fuel injection of the cylinder is more than that of other cylinder. *Extreme correction value identifies a problematic injector. After replacinga injector with new one, reset & confirm the engine condition.

EFBC660R

15. Replace the default injector, and then repeat previous test modes to check if the injector is normal.

WIRING HARNESS INSPECTION

Refer to P0261 ~ P0272 DTC inspection procedures.

ACCUMULATOR

DESCRIPTION EE1BEF8D

The common rail stores the fuel at high pressure. At the same time, the pressure oscillations which are generated due to the high-pressure pump delivery and the injection of fuel are damped by the rail volume. This common rail is common to all cylinders, hence its name "common rail". Even when large quantities of fuel are extracted, the common rail maintains its inner pressure practically constant from the moment the injector opens.

In order to comply with the wide variety of engine installation conditions, the common rail with its flow limiters and the provistions for attaching rail pressure sensor, fuel pressure control valve, and pressure limiter valve is available in a number of different designs.

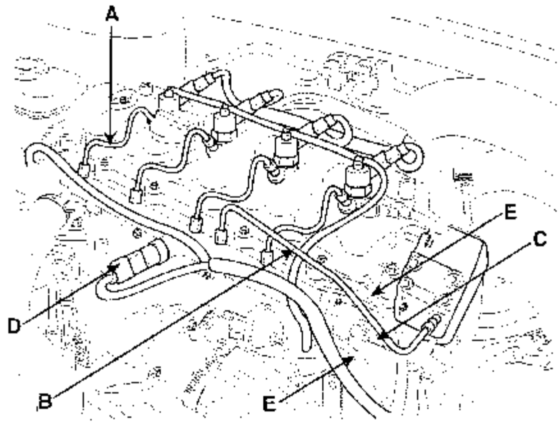
The available common rail volume is permanently filled with pressurized fuel. The compressibility of the fuel resulting from the high pressure is utilized to achieve the accumulator effect. When fuel leaves the rail for injection, the pressure variations resulting from the pulsating fuel supply from the high-pressure pump are compensated for.

REMOVAL

CAUTION

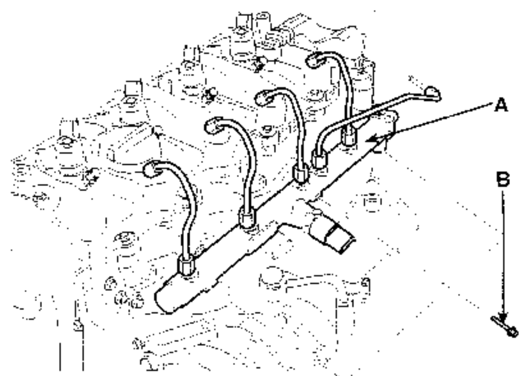
- Common Rail Fuel Injection System is subject to extremely high pressure (Approximately 1,350 bar)
- Never perform any work on injection system with engine running or within 30 seconds after the engine stops.
- Always pay attention to·asfety precaution.
- Ensure the absolute cleanliness.
- It is not recommended to remove the injectors without any notice.

1. Turn ignition switch to OFF position
2. Disconnect the negative battery (-) terminal and wait for about 30 seconds
3. Remove the high pressure pipe (A) connecting injectors and common rail
4. Remove the high pressure pipe (B) connecting high pressure pump and common rail.
5. Disconnect the fuel pressure regulator connector (C) and rail pressure sensor connector (D).
6. Disconnect the return lines (E).



LWGE004R

7. Remove the common rail (A) by unscrewing the three mounting bolts (B).



LWGE004S

INSTALLATION

Tightening Torques
common rail mounting bolt :
8 ~ 10 N·m (5.9 ~ 7.37 lb·ft)

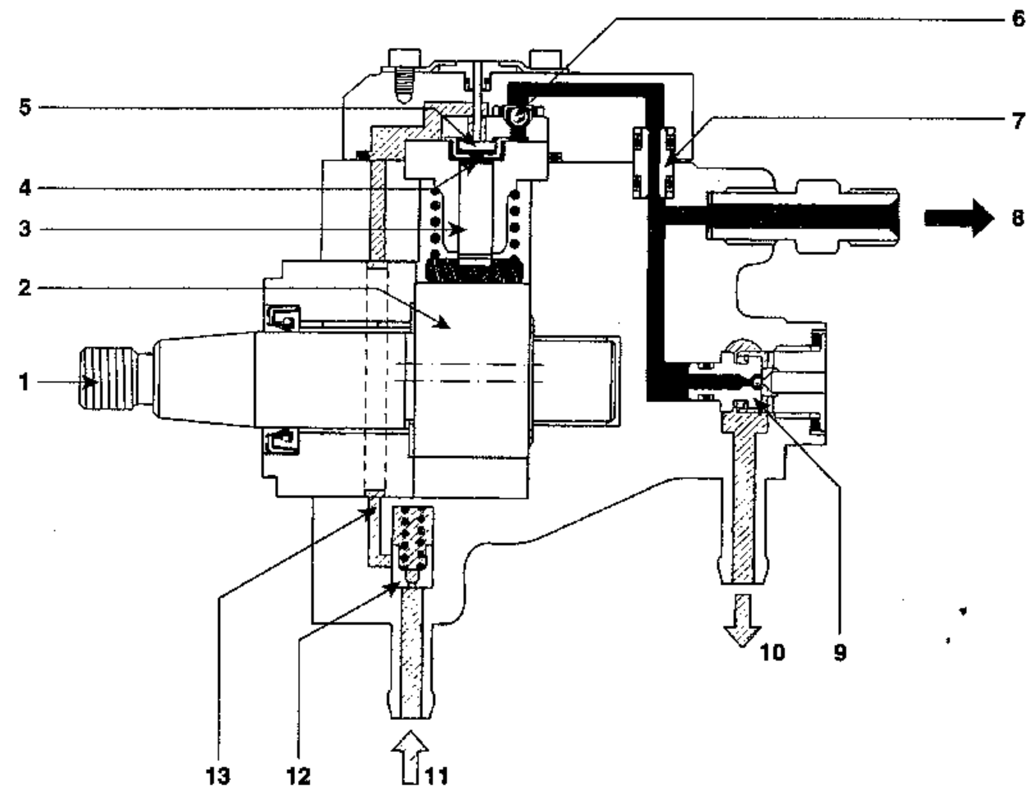
Installation is in the reverse order of removal.

Tightening Torques
Common rail mounting bolt:
8 ~ 10 N·m (5.9 ~ 7.37 lb·ft)
High pressure installation nut:
25 ~ 29 N·m (18.44 ~ 21.39 lb·ft)

HIGH PRESSURE FUEL PUMP

DESCRIPTION EBBCBEFA

The high-pressure pump is the interface between the low-pressure and the high-pressure stages. Under all operating conditions, it is responsible for providing adequate high-pressure fuel through out the vehicle's complete service life. This also includes the provision of extra as needed for rapid starting and for rapid build-up of pressure in the rail. The high pressure pump continually generates the system pressure as needed in the high-pressure accumulator (common rail). This means therefore, that in contrast to conventional systems, the fuel does not have to be specially compressed for each individual injection process.

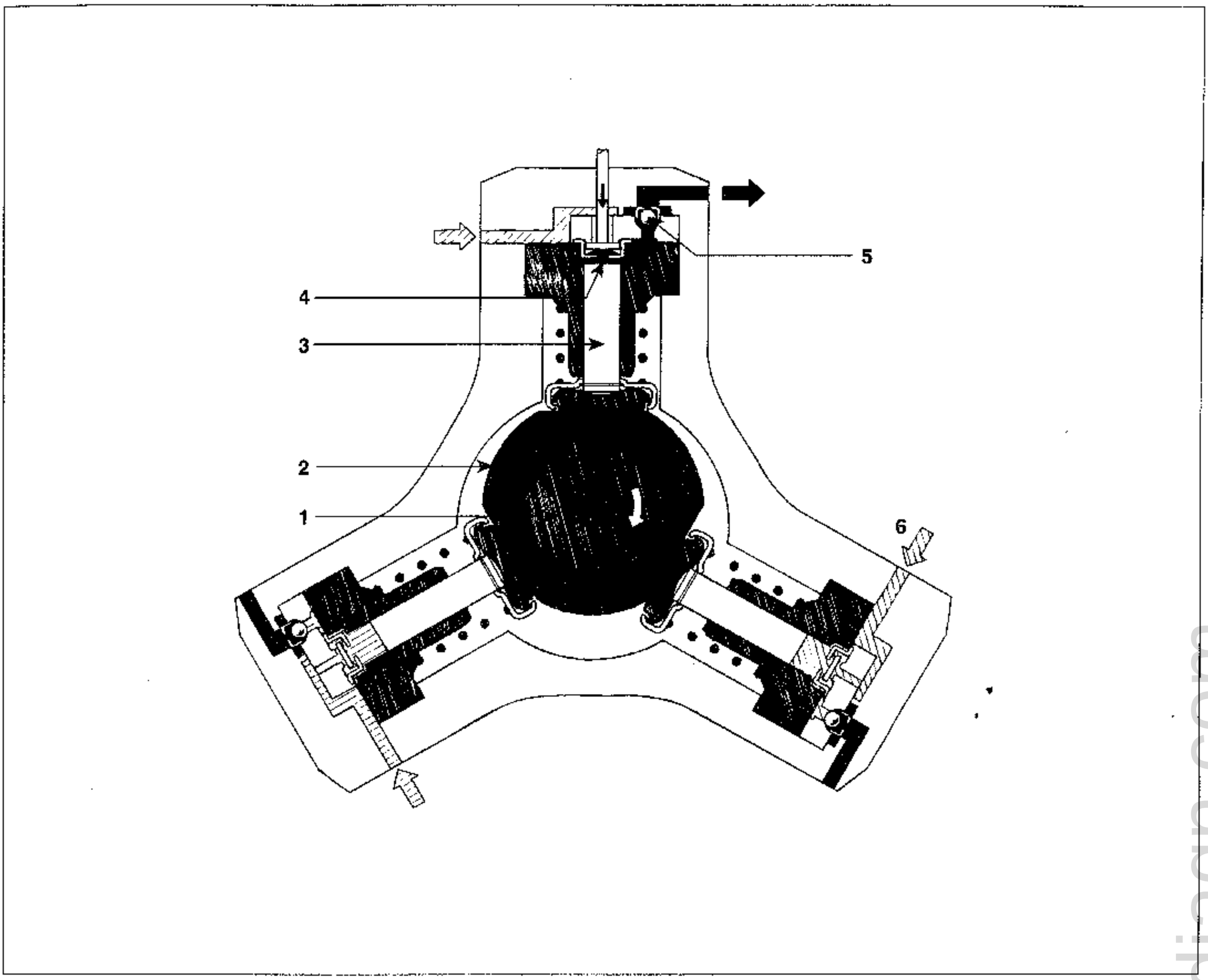


1. Driveshaft
2. Eccentric cam
3. Pumping element with pump plunger
4. Pumping-element chamber
5. Suction valve
6. Outlet valve
7. Seal
8. High-pressure connection to the rail
9. Ball valve
10. Fuel return
11. Fuel inlet from the fuel pump
12. Safety valve with throttle bore
13. Low-pressure passage to the pumping element

LWGE004T

The high-pressure pump is installed preferably at the same point on the diesel engine as a conventional distributor pump. It is driven by the engine (at half engine speed, but max. 3000 rpm) through a coupling, gear wheel, chain, or toothed belt, and lubricated by the diesel fuel pressure control valve is installed directly on the high pressure pump or remote from it. Inside the high pressure pump, the fuel is compressed with theree radially arranged pump pistons which are at an angle of 120° to each other. Since three delivery stokes take place for every revolution, only low peak drive torques are generated so that the stress on the pump drive remains uniform. With 16 N·m, the torque is only about 1/9 of that required to drive a comparable distributor pump. This means that Common Rail places lessloading on the pump drive than is the case with conventional injection system. The power required to drive the pump climbs in proportion to the pressure set in the rail and to the pump's speed (delivery quantity).

For a 2-liter engine turning at rated speed, and with a set pressure of 1,350 bar in the common rail, the high pressure pump requires 3.8kW presuming a mechanical efficiency of approx. 90%. The higher power demand (higher than theoretically necessary) results from the leak-fuel and control quantities at the injector, and from the fuel return through the fuel pressure control valve.



1. Driveshaft
2. Eccentric cam
3. Pumping element with pump piston
4. Inlet valve
5. Outlet valve
6. Inlet

LWGE004U

METHOD OF OPERATION

Via a filter with water separator, the fuel pump pumps fuel from the tank to the high-pressure pump through the fuel inlet and the safety valve. It forces the fuel through the safety valve's throttle bore and into the high pressure pump's lubrication and cooling circuit. The driveshaft with its eccentric cams moves the three pump plungers up and down in accordance with the shape of the cam. As soon as the delivery pressure exceeds the safety valve's opening pressure (0.5 ~ 1.5 bar), the fuel pump can force tuel through the high pressure pump's inlet valve into the pumping-element chamber whose pump piston is moving downwards (suction stroke). The inlet valve closes when the pump piston passes through BDC and, since it is impossible for the fuel in the pumping-element chamber to escape, it can now be compressed beyond the delivery pressure.

The increasing pressure opens the outlet valve as soon as the rail pressure is reached, and the compressed fuel enters the high pressure circuit. The pump piston continues to deliver fuel until it reaches TDC (delivery stroke), after which the pressure collapses so that the outlet valve closes. The fuel remaining in the pumping-element chamber drops below the fuel pump pressure, the inlet valve opens and the pumping process starts again.

FUEL-DELIVERY RATE

Since the high-pressure pump is designed for large delivery quantities, excess high pressure fuel is delivered during idle and part-load operation. This excess fuel is returned to the tank via the fuel pressure control valve. The compressed fuel relaxes in the tank, and the energy is lost which was used for compressing the fuel in the first place. In addition to the unnecessary heating up of the fuel, over all efficiency is also reduced. To a certain extent, this loss of efficiency can be compensatd for by switching off one of the pumping elements.

TRANSMISSION RATIO

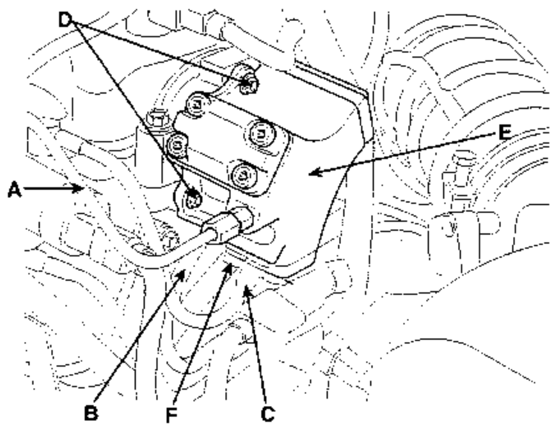
The high-pressure pump's delivery rate is proportional to its rotational speed. And this, in turn, is a function of the engine speed. During the injection-system application-engineering work on the engine, the transmission ratio is defined so that on the one hand the amount of excess fuel is not too high, and on the other, the fuel requirements can still be satisfied during WOT operation. Referred to the crankshaft, transmission ratios of 1:2 and 2:3 are possible

REMOVAL EB9AAE8E

CAUTION

- Common Rail Fuel Injection System is subject to extremely high pressure (Approximately 1,350 bar)
- Never perform any work on injection system with engine running or within 30 seconds after the engine stops.
- Always pay attention to safety precaution.
- Ensure the absolute cleanliness.
- It is not recommended to remove the injectors without any notice.

1. Turn ignition switch to OFF position.
2. Disconnect the negative battery (-) terminal and wait for about 30 seconds.
3. Remove the high pressure pipe (A) connecting high pressure pump and common rail.

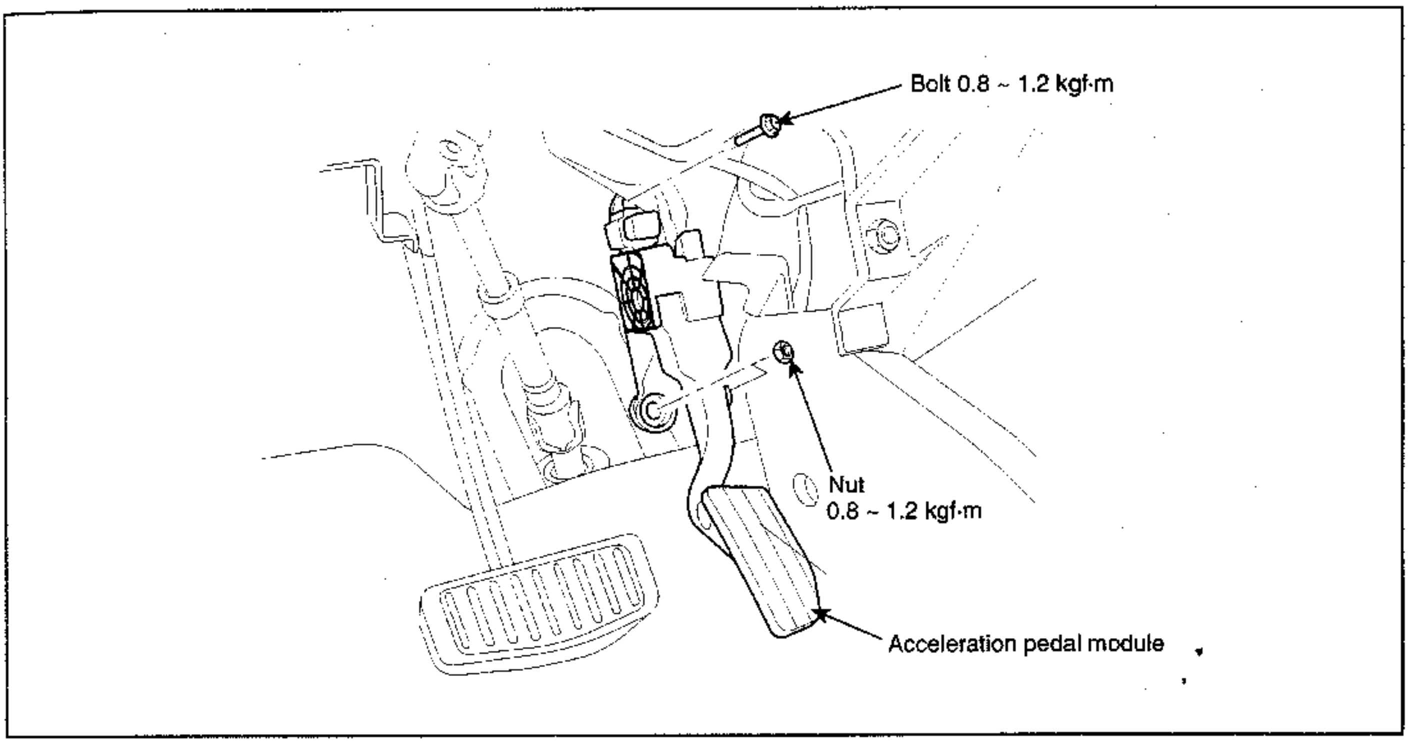


KFQE004N

4. Release the flange bolt (F) and disconnect the fuel feed line (B) from fuel filter.
5. Disconnect the fuel return lines (C).
6. Unscrew the three high pressure mounting bolts (D) and remove the high pressure pump (E).

ACCELERATION PEDAL

COMPONENTS EOE59CF4



EFQE004B

REMOVAL ECAF2AF3

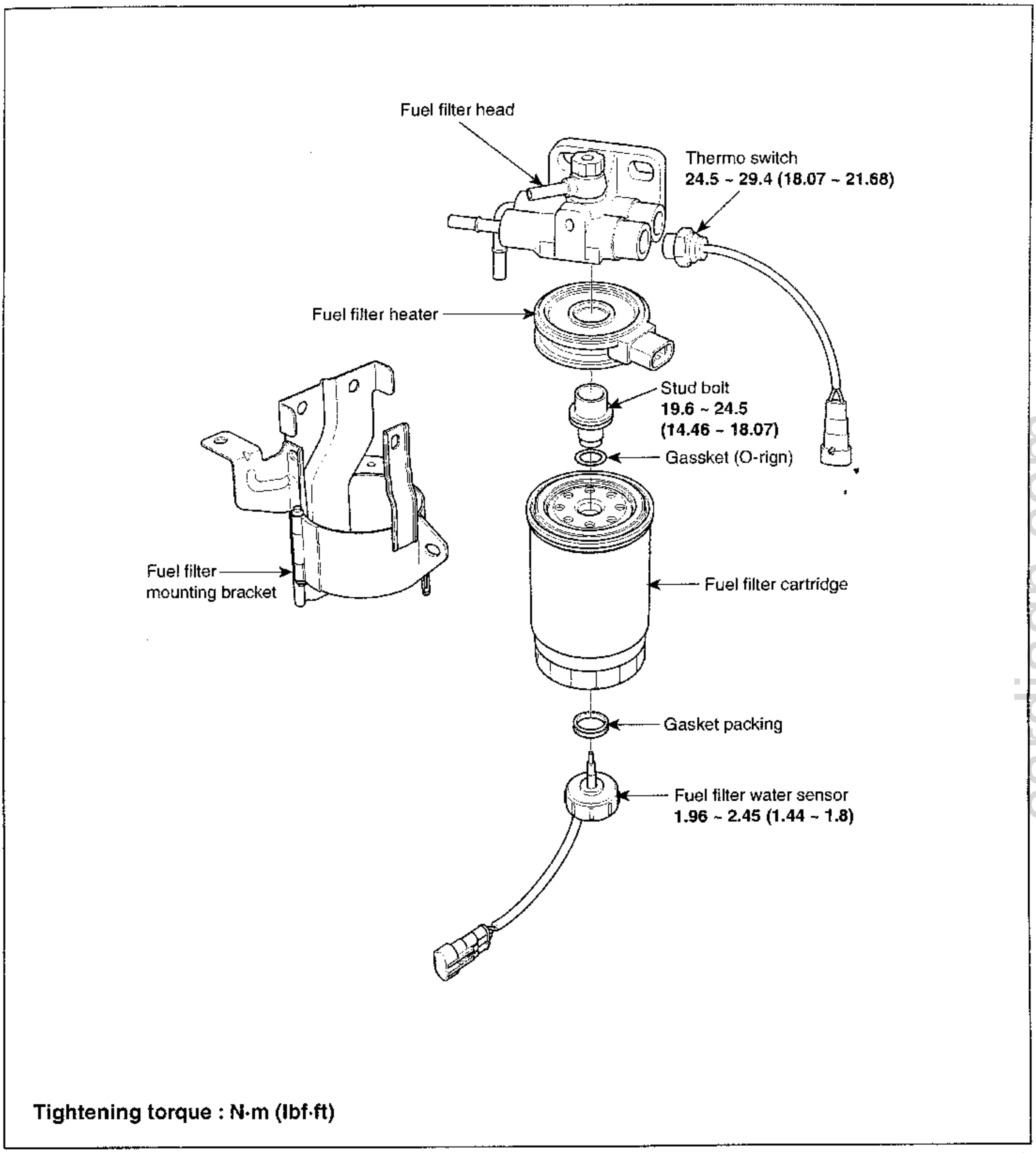
1. Unfasten acceleration pedal module mounting nuts(-2EA) and bolt(1EA).
2. Remove acceleration pedal module assembly.

INSTALLATION EFAF7F0E

Installation is in reverse order of removal.

FUEL FILTER

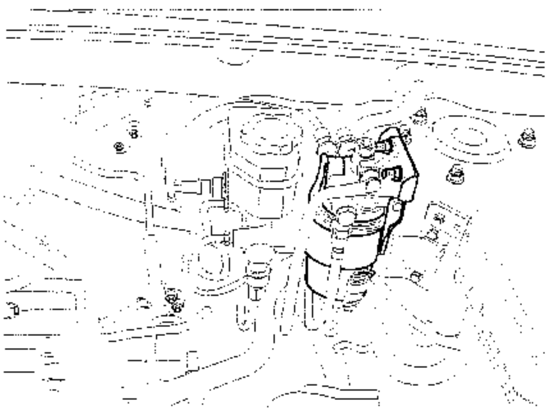
COMPONENTS EAE9EEA5



EFQE004C

REMOVAL EF5C6C1A

1. Turn ignition switch to OFF position.
2. Disconnect the negative battery (-) terminal and wait for about 30 seconds.
3. Remove the air cleaner assembly.
4. Before disconnecting fuel hose, spread out service towel under the fuel filter not to contaminated by fue-l.



KFOE004E

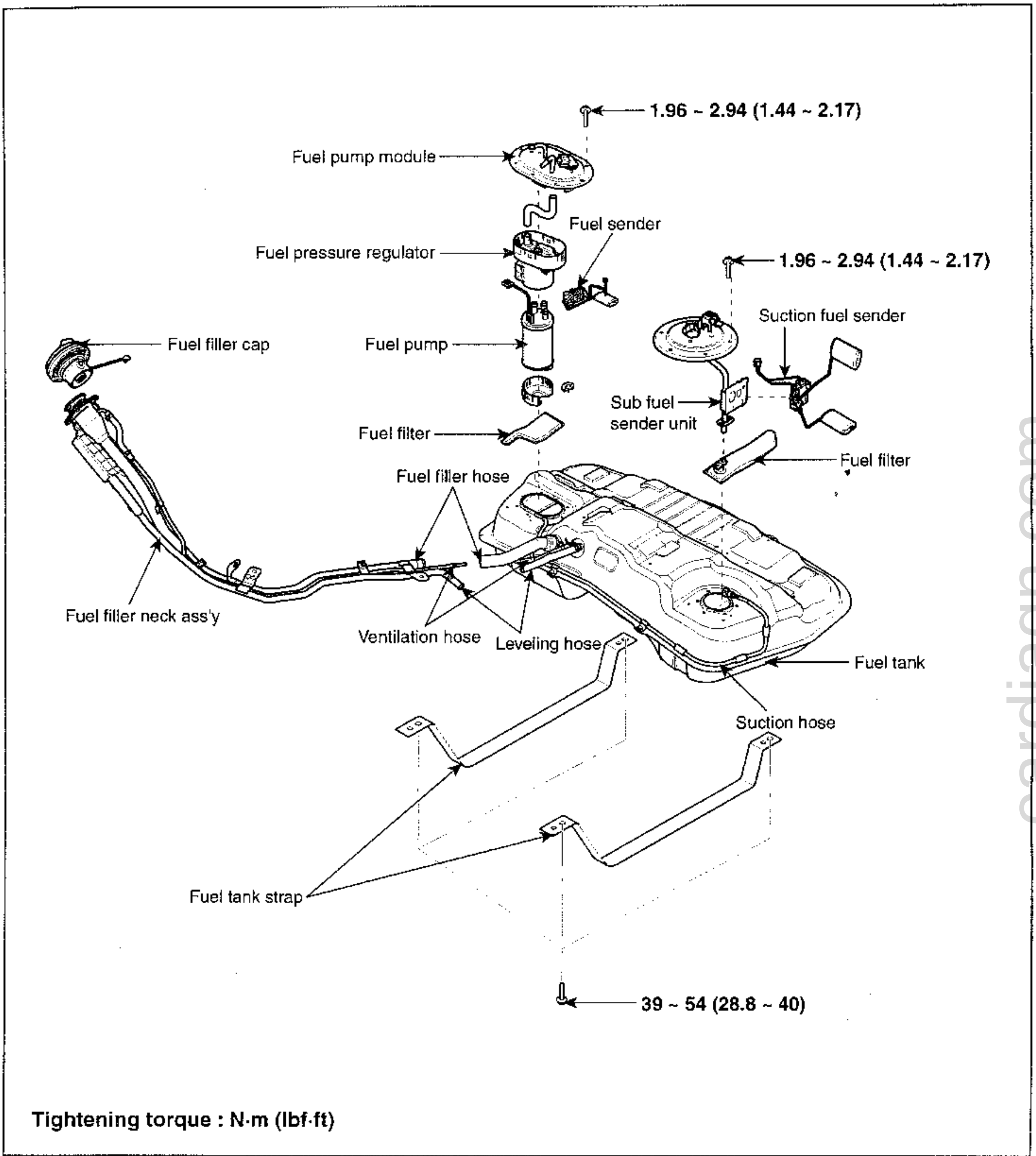
5. Disconnect the heater connector, water sensor conn-ector and thermo switch connector.
6. Unfasten fuel filter bracket mounting nut(1EA) and bolts(2EA) and remove the fuel filter assembly.
7. Unfasten mounting nut (2EA) and bolts(3EA) on fuel filter head and bolt(1EA) in fuel filter bracket.

INSPECTION E287F12A

1. General inspection
   a. Hose and pipe for bent, damage, clogging or corr-osion.
   b. Fuel filter for cologging and damage.
2. The fuel filter inspection must be complete in case of below.
   a. Draining fuel in fuel tank and then refilling fuel.
   b. Replacing the fuel filter.
   c. Removing the main fuel hose(pipe).

FUEL TANK

COMPONENTS E7F7CFBD

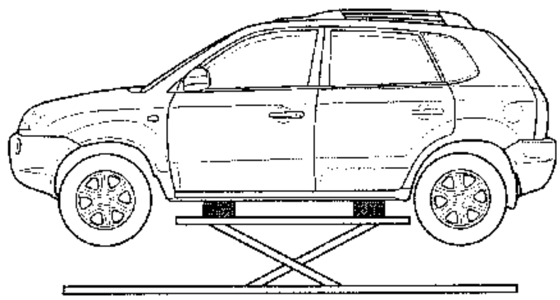


EFCE004F

REMOVAL E3FDA6C5

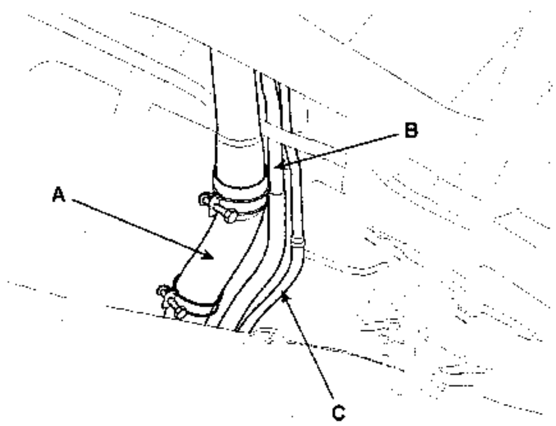
⚠ CAUTION

When lifting up or down vehicle, be sure to place blocks between vehicle and lifter to prevent fuel tank from being damaged.



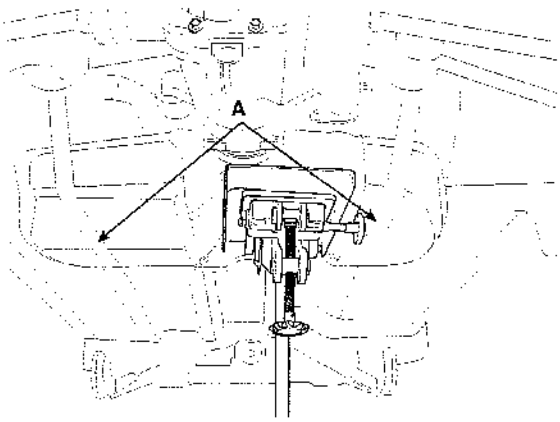
EFQE004V

1. Remove front muffler and main muffler assemblys.
2. Remove profellershaft assembly. (4WD only)
3. Remove fuel tank under cover.
4. Remove clamps(3EA) for fuel filler hose(A), leveling hose(B) and ventilation(C).



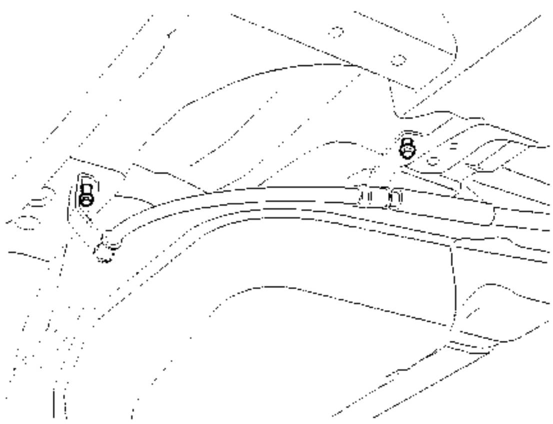
KFQE004G

5. Support fuel tank with jack and remove fuel tank straps(2EA).



KFQE004H

6. Unfasten parking brake cable mounting bolts(2EA) in each right and left sides.



KFQE004I

7. Lifting down fuel tank slowly, remove fuel pump wiring connector, and then main fuel hose and return fuel hose connected to fuel fank.
8. Disconnect fuel sender wiring connector.
9. Remove fuel tank.

INSTALLATION EDB1BCC8

Installation is in reverse order of remaval.

DISASSEMBLY ECF2CAC1

1. Remove the suction hose between fuel pump module and sub fuel sender unit.

2. Unscrew fuel pump module mounting bolts and sub fuel sender unit mounting bolts.

   ⚠ *CAUTION*

   When lifting up fuel pump module and sub fuel sender, be careful not to do damage to the sender.

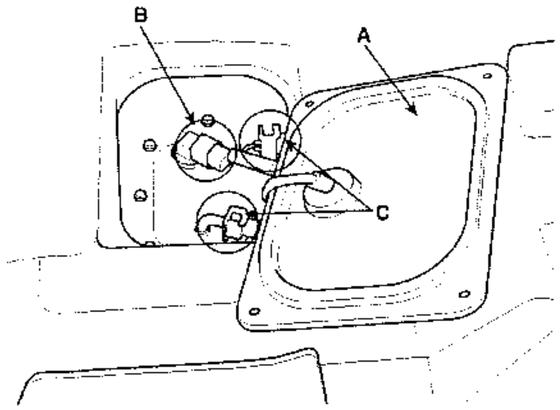
ASSEMBLY EF038955

Assembly is in reverse order of disassembly.

FUEL PUMP

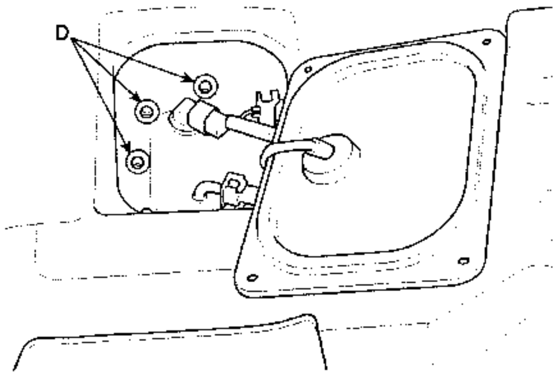
DISASSEMBLY EB638E5B

1. Turn ignition key off and disconnect battery (-) cable-.
2. Remove the second seat.
3. Remove the capet covering service cover (A) for fuel pump and service cover (A).



KFQE986A

4. Disconnect the fuel pump wiring connector(B).
5. Spread out service towel around fuel hoses(C) and disconnect fuel hoses(C).
6. Unscrew fuel pump plate mounting bolts(D).



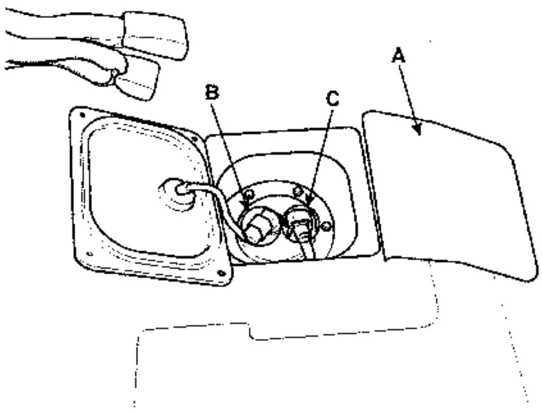
KFQE985A

7. Remove the fuel pump module.

SUB FUEL SENDER

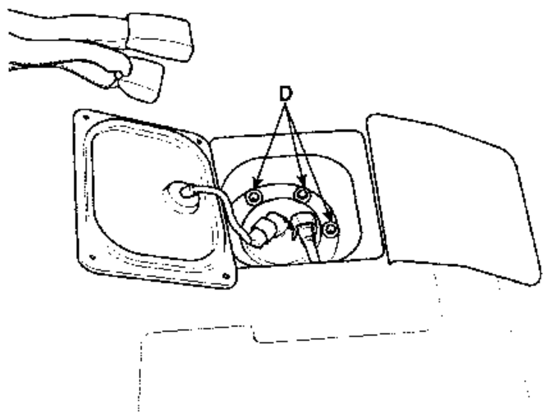
DISASSEMBLY E8CEECD9

1. Turn ignition key off and disconnect battery (-) cable-.
2. Remove the second seat.
3. Remove the capet covering service cover(A) for sub fuel sender unit and service cover.



KFQE004O

4. Disconnect the sub fuel sender wiring connector(B)
5. Spread out service towel around fuel hoses(C) and disconnect fuel hoses(C).
6. Unscrew sub fuel sender plate mounting bolts(D).



KFQE9B3A

7. Remove the suction fuel sender unit.